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FROM

48TH CONGRESS, 1st Session. } SENATE. { Ex. Doc. No. 198.

THE

MARITIME CANAL OF SUEZ,

FROM

ITS INAUGURATION, NOVEMBER 17, 1869,

TO

THE YEAR 1884.

PREPARED UNDER ORDERS OF THE BUREAU OF NAVIGATION,
NAVY DEPARTMENT,
BY
PROF. J. E. NOURSE, U. S. N.

JUNE 27, 1884.—Referred to the Committee on Commerce and ordered to be printed.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1884.

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June 26, 1906
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William Cameron Forbes,

NAVY DEPARTMENT,
Washington, June 26, 1884.

SIR: I have the honor to retransmit to the Senate the report of Prof. J. E. Nourse, United States Navy, on the Suez Canal.

The report was returned to this Department by the Senate on the 8th of January, 1884, for the purpose of adding to it important information received since it was submitted March 30, 1882. It is now completed.

Very respectfully, your obedient servant,

WM. E. CHANDLER,
Secretary of the Navy.

Hon. GEORGE F. EDMUNDS,
President pro tempore of the Senate.

NAVY DEPARTMENT,
Washington, July 3, 1884.

SIR: Referring to my letter of the 26th ult, I have the honor to transmit herewith six additional illustrations needed for the completion of the report on the Suez Canal, forwarded to the Senate on the date named.

Very respectfully,

WM. E. CHANDLER,
Secretary of the Navy.

Hon. GEORGE F. EDMUNDS,
President pro tempore of the Senate.

LETTER OF TRANSMITTAL.

NAVY DEPARTMENT,
Washington, March 20, 1882.

SIR: I have the honor to submit herewith to the Department a paper descriptive of the maritime canal of Suez, to the study of which I have been directed by its connection with the general subject of interoceanic communication.

The history has for its basis of authority chiefly the information liberally placed before me by the president of the canal company while on duty in Paris in the year 1875, together with other official reports and correspondence freely contributed by him from the year 1867 to the present date, especially the five volumes of the "Lettres Journal et Documents," of M. de Lesseps, for the years 1854 to 1869, inclusive. In order to present the fullest available data, I have made use of English authorities; from the Parliamentary reports, the returns made as late as 1883 by the English directors now holding place in the council of the company; also, the returns to the State Department from our own consuls.

The reports to the Department from the commanders of eleven of the United States steamers which have passed through the canal have furnished data of much interest, confirming the opinion of one of their commanders that "its navigation is in many of its features exceptional, and of a character to interest officers of the service."

An abstract of the earliest of these papers is made from the Secretary of the Navy's report of 1870, with copies of such others as have been found on the files of the Department.

I indulge the hope that the statements now presented may prove useful, both as a *résumé* of the route itself, and in relation to any canalization proposed for our own Isthmus; and this despite of well-known, essentially diverse physical characteristics.

The experience of the Suez Canal seems to be especially instructive by its full success in the construction of a "harbor against nature," an argument cumulative in favor of reclaiming any shoaled harbor. Its experience further shows the stimulation of an unprecedented activity in the commerce and revolutionized ship-building of the eastern hemisphere.

These facts justify the expectation that the opening of a canal across our own Isthmus will produce like results—the revival of our own commercial marine, and of those closer relations with the western shores of America and with Eastern Asia, which belong essentially to the United States.

I have the honor to be, very respectfully, your obedient servant,

J. E. NOURSE,
Professor, U. S. N.

Commodore J. G. WALKER,
Chief of the Bureau of Navigation, Navy Department.

THE MARITIME CANAL OF SUEZ.

CHAPTER I.

The commercial and financial results of the route from the opening, 1869, to the year 1884.—Cost of construction.—Table of distances saved by the canal.—Its line indicated by nature.—Limits of elevation.—Rejection of the plan for locks.—Historic traditions of the old canal.—Lepere's report to Napoleon.—Waghorn's overland route.—Railroad from Cairo.—Line proposed by Talabot and others.—Lesseps' studies, 1849 to 1854: early friendship with Said Pasha; invited to Egypt. 1854: gains the concession; explores the Isthmus.—Report of the "Interoceanic Commission."—Opposition in the English Parliament.

ERRATA.

[Sen. Ex. Doc. 198.]

Page 9, line 19, for "cause" read "causes."
Page 9, line 32, for "was" read "were."
Page 21, line 20, for "Mongul" read "Mougel."
Page 39, line 15, omit the semicolon.
Page 41, line 25, for "commerce from the enemy" read "the commerce of an e
Page 50, line 31, for "Mesée" read "Musée."
Page 118, line 18, for "last" read "that."

[illegible] is about 10 miles;
the length of the canal is 160 kilometers, or 88 nautical = 99.90 statute miles. The canal is an open cut—*à niveau*—without a lock. Its floor in the channel is 72 feet; at the surface the breadth varies from 190 feet where the banks are high to 328 feet where they are low. The limit of draft permitted for ships passing through is 7.50 metres (24.6 feet). Fourteen steamers drawing 7.50 meters have passed with readiness during the year 1883. The French and English charts mark the soundings in the channel at no point less than 25 feet; generally from 26 to 30 feet.

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THE MARITIME CANAL OF SUEZ.

The ship-canal which connects the Mediterranean with the Red Sea has for its northern entrance the harbor of Port Said, latitude north 31° 15′ 45″, longitude east 32° 18′ 45″, and for its outlet on the Red Sea the roadstead of Suez, latitude north 29° 58′ 40″, longitude east 32° 33′ 13″.

The distance across the Isthmus in a direct line is about 70 miles; the length of the canal is 160 kilometers, or 88 nautical = 99.90 statute miles. The canal is an open cut—*à niveau*—without a lock. Its floor in the channel is 72 feet; at the surface the breadth varies from 190 feet where the banks are high to 328 feet where they are low. The limit of draft permitted for ships passing through is 7.50 metres (24.6 feet). Fourteen steamers drawing 7.50 meters have passed with readiness during the year 1883. The French and English charts mark the soundings in the channel at no point less than 25 feet; generally from 26 to 30 feet.

The commercial and financial results of the route are shown by the following official table of the *Mouvement et Recettes*:

Years.	Ships.	Net tonnage.	Receipts.	
			Francs.	*Dollars.*
1870	486	436,609	5,159,327	1,031,865
1871	765	761,467	8,993,732	1,798,746
1872	1,082	1,160,743	16,407,591	3,281,518
1873	1,173	1,367,767	22,897,319	4,579,465
1874	1,264	1,631,650	24,857,383	4,971,476
1875	1,494	2,009,984	28,886,302	5,777,260
1876	1,457	2,006,771	29,974,998	5,994,599
1877	1,663	2,355,447	32,774,344	6,554,868
1878	1,593	2,269,678	31,096,229	6,219,645
1879	1,477	2,263,332	29,686,060	5,937,212
1880	2,026	3,057,421	41,820,899	8,364,179
1881	2,727	4,136,779	54,676,189	10,935,238
1882	3,198	5,074,808	63,409,593	12,681,918
1883	3,307	5,775,861	68,512,064	13,702,413

The strongest testimony to the established success of the route is found in the assembling at the date of June 22, 1884, of an International Commission to consider the problem of the fuller enlargement of the canal to accommodate the daily increasing demands of commerce. The Commission is composed of some of the most distinguished engineers of Great Britain, Germany, Holland, Spain, Italy, Austria-Hungary, and Russia, as well as of those of France, and with them the chiefs of the large steam companies, such as the Peninsular and Oriental, the Company of Navigation for British India, and others.

In regard to this enlargement the following notes are furnished by Lieutenant-Commander C. F. Goodrich, U. S. Navy, who was on duty in Egypt, reporting to the Navy Department the British naval and military operations of the occupation of 1882:

WASHINGTON, *July* 4, 1884.

DEAR SIR: In reply to your favor of the 20th ultimo I have to state that the number of vessels passing through the Suez Canal reached, several years ago, such a point as to seriously tax the accommodation afforded by the *gares* or turnouts, whose capacity, by the way, is the measure of the capacity of the canal itself. To meet the increased demands of commerce the gares were lengthened so that the trains, so to speak, of vessels traveling together in the same direction could be made larger. This process still goes on.

As a safe distance must be preserved between the vessels of each train, the time required for hauling into the gare is, practically, the time required for the *garing* all the ships, plus that occupied by the last ship in arriving at the gare. The ships *gared* must now wait for the passage of the whole train bound in the opposite direction.

The rear ship may be as much as 2 miles from the van, and as the maximum speed allowed is 5.3 knots it is readily seen that a limit to this method is soon reached. Upon this fact is based the objection to the improvement of the canal by merely extending its *garing* facilities.

A peculiar feature of the passage of the canal is the impossibility, in the present condition of affairs, of going from one end to the other between daylight and dark. When night falls, traffic is closed and valuable hours are lost. Since the whole distance is only 87 nautical miles (I speak from memory), and since the 15 miles across the Bitter Lakes may be covered at full speed, it follows that a good ship might easily,

in summer at least, enter the canal at daybreak and leave it before the light has entirely disappeared. In these times of high speed and quick trips such a consummation is devoutly to be wished for.

The problem now under consideration by the officers of the company is whether it is advisable to double the width of the present waterway* or to dig a second and parallel canal—one to be devoted to south-bound and the other to north-bound traffic.

The first scheme involves loss of time in slowing down to pass an approaching vessel, as well as considerable risk of collision, with the attendant possibility (if not probability) of blocking the whole commerce of the canal. I venture to hope that the second solution will be adopted. The advantage appears to me so great as to more than compensate for the additional cost. A company that finds difficulty in keeping dividends below 25 per cent. need not recoil before even so great an outlay, while it would secure some economy in administration.

By means of connections here and there between the two canals, a stoppage in any one section would only throw the whole traffic into the corresponding section of the other canal, which could be worked as a single track (the present method) for the time being. It is proper to state that these views were formed by me on the spot, after experiencing on several occasions the annoyance of long delays through trivial cause.

In relation to the shape of the canal permit me to say that the original plans contained very elaborate cross-sections. The shallower parts were intended for light-draught vessels and native boats. This was to be the section where the soil was very light, as, for instance, along the line from Ras-el-Ech to Port Said. Practically, however, a uniform width of floor of 72 feet is maintained throughout, while the sides have gradually (as was to be expected) assumed their natural talus.

Very truly yours,

C. F. GOODRICH,
Lieutenant-Commander, U. S. Navy.

COST OF CONSTRUCTION.

As in the case of the larger number of all other public works the net cost of construction is with difficulty ascertained; it has largely exceeded the original estimates. The original capital subscribed was 400,000 shares of 500 francs each, or $40,000,000. Fifty francs was to be paid on application, 150 on allotment. No further sum was to be demanded for two years, and 5 per cent. interest was to be paid to the shareholders, dating from the delivery of the scrip. In less than one month this stock was taken, the lists closing November 30, 1858. The company began their work with nearly $20,000,000 cash in hand. This sufficed for the works until the year 1868, when a fresh loan was made, under the title of bonds to the amount of $20,000,000. The aggregate of this subscription with the original stock is 300,000,000 francs, or $60,000,000. But to this must be added various receipts of large sums, such as the indemnity by Egypt in 1864, and grants from the same source, and of sales of property in 1869, amounting to more than another 100,000,000 francs, which, together with receipts of smaller revenues, made in all, at the date of December 31, 1869, the following statement in the *Compte Général*, "£12,000,000 sterling had been subscribed and about £18,100,000 or nearly $92,000,000 expended. Within this expenditure, however, is in-

* By the International Commission of June, 1884, the decision has been made in favor of doubling the width of the present canal throughout.

cluded the purchase of a large amount of machinery and also of land; the machinery has been in part available for keeping open without further cost the harbors and the canal bed, while part has been sold. Revenues are still returned for sales of land and other of the company's property, such sales for the nine months of the year 1881 amounting to about 33,000 francs. The original cost was swollen by the impediments thrown in the way by the English, which necessitated at one time a suspension of the work as well as alterations in plans; the first estimates were based upon forced native labor, which, when arbitrarily withdrawn, compelled the purchase of very expensive machinery. Allowing for the increase of cost arising from these causes and others, such as the prevalence of cholera in the year 1865, it may be set down as a true statement that the cost of construction was $93,000,000. The enemies of the work had confidently announced that the sum actually needed would most certainly double the last named figures.

The reports of United States Consul-General Farman and of Consul Van Dyke to the State Department have been of a character highly favorable to the canal. Mr. Farman states that the whole cost of the work, including that of improvements, was, exclusive of repairs and cleaning, to the end of the year 1877, $92,273,907. The actual cost to the company, exclusive of aid received from Egypt by the award of 84,000,000 francs arbitrated by the Emperor of the French and of 10,000,000 francs from the retrocession of lands, was $69,271,907. He adds that "had the company constructed the canal wholly by laborers hired in the ordinary way, and without grants from Egypt, except the right of way and the necessary lands for stations, the canal proper and its adjunct, the fresh-water canal, would have cost them $108,080,000, and this in a country where ordinary labor was worth less than 10 cents a day, the laborer boarding himself." This estimate of the consul is based on the fact that at the time of the large award made by the Emperor the labor that had already been furnished by the Egyptian Government was worth $7,600,000 more than it had cost them; but it will be remembered as regards this value of the laborer "at 10 cents a day," that he had received from the company much better wages than this, so that it would appear probable that the last item here named would have been further increased; the reduction of cost by the change from native labor to that of machinery was great. The consul gives the revenue of the canal for the year 1877 as $6,525,448.

OFFICIAL STATEMENT OF THE COST.

In a letter received March 15, 1882, through Mr. James Jackson, M. Fontane, of the Suez Canal Company's office, in reply to some inquiries made of the company, writes:

[Translation.]

PARIS, *February* 24, 1882.

The total cost of the canal, if we count that of the excavation only of the maritime canal, was 200,000,000 francs. This was the estimate at first of the International

Commission (1856), and it is remarkable that this estimate of M. de Lesseps was confirmed by the facts of the case.

Unfortunately, the opposition of the English Government cost the delay of a number of years in the practical execution of the work, during which time, although the cutting was interrupted, it was necessary to pay the 5 per cent. interest promised to the original stockholders, thus necessitating an issue of obligations.

Besides this, the sovereign of Egypt, pressed by political opposition, seriously hindered the work by failing not only in respect of his engagements to M. de Lesseps, but as to those also by which he had bound the latter.

An imperial arbitration of this by the Emperor Napoleon III brought into the company's treasury a valuable sum, which was, however, necessarily expended in righting and repairing the evils which had been created. It is difficult, therefore, to separate and apply precisely these items of expenditure, but it may be said correctly that the cutting of the canal itself cost 200,000,000 francs and the opposition of England 100,000,000 more.

The expenses of the canal for the year have been about 28,800,000 francs, which includes the payment of interests on the social (original or founders' stock), and on the subsequent loans, and the expenses of the improvements of the canal.

These, according to a special agreement (1876 with England), are of the value of 1,000,000 francs per annum. They consist in the creation or enlargement of the basins and of the gares, (sidings,) according to the need developed and the urgency of the case, and in the strengthening of the banks of the canal and all other work which proves necessary to secure the permitted readiness of transit of ships.

M. FONTANE.

NOTE.—In reply to charges of extravagant outlay and of despoiling Egyptian finances, made in the North American Review for March, 1880, M. de Lesseps, after adverting to the earliest points in the history of the work, says that when, in 1856, the pasha renewed the concession of 1854, as the political position of Lord Palmerston threatened serious embarrassment to Egypt on account of the canal, the viceroy preferred to delay the call upon capitalists for the formation of the financial company, and proposed himself to furnish a monthly budget of 30,000 francs, in order to remain master of the enterprise until it would be a favorable time for opening the work to foreign capitalists. On his part, M. de Lesseps engaged to return to the pasha the concession without any indemnity for outlays already made if political circumstances should not permit the construction of the work.

"The preparatory labors went on in this way until the year 1858, when the favorable moment seemed to have arrived for a call on the capitalists for 200,000,000 francs, the estimate which had been made by the International Commission. And the Pasha recommended that the whole of this stock should not be offered in France only, but a part reserved for other countries, engaging himself to secure such distribution at a later date if there were calls for it, so that it should not be said that the company was in the hands exclusively of French capitalists.

"The stock taken in France of 120,000,000 francs represented 240,000 shares of 500 francs each. The part reserved by the viceroy was 80,000,000 francs, representing 160,000 shares.

"The first case of the company's counsel of administration was to reimburse the sums expended for the preparatory works by payment for these to the viceroy and to the parties who had been engaged upon them.

"One of the first arguments of Lord Palmerston in the outset of the English diplomacy against the interests of the canal was that France would send Zouaves disguised among the workmen (at a later date to take possession of Egypt); it was then that the viceroy by agreement with M. de Lesseps decreed that four-fifths of the laborers should be Egyptians and engaged for himself to secure the monthly supply of 20,000 men necessary for the execution of the work, by discharging an equal number

from his army of 60,000. The decree for the employment of the fellahs is a model of justice, humanity, and of wise foresight; it was published in different languages and every one could read it.

"At the death of Said Pasha, his successor, Ismail, declared in the presence of the representatives of foreign powers that he had no other desire than the faithful execution of the engagements of his predecessor with the canal company. Consequently, the accustomed labor was employed upon the works, and by the terms of the decree which has been named, the laborers received a daily pay higher than that paid to those working on private property in Egypt, besides their rations of bread, water, pulse, &c. A circular of the president of the company ordered that any employé or agent of the canal who should strike an Arab should be dismissed from the service, no matter what his rank or grade might be; and as to the pretended mortality among them, the reports of the doctors, published every year, show that it was really less along the whole line of the work than that of the most healthful garrisons of France, and less among the natives than among the Europeans.

"Everything went on regularly until Lord Palmerston sent to Egypt Sir Henry Bulwer, the English embassador at Constantinople. This diplomat, after a journey through the Isthmus, obtained from the viceroy the promise to deprive the Suez Canal Company of the laborers, of the fresh-water canal constructed at the company's expense, and of the 60,000 hectares of land (more than 130,000 acres) which had been conceded along its banks. The intention plainly was to ruin the work, and, as it was a violation of our contract and without the allowance of any compensation, the president and the council of administration naturally resisted such a pretension, and referred to the French tribunals the Egyptian minister, who had begun to sustain this spoliation of the French stockholders, to the French courts.

"While we were thus resisting it and M. de Lesseps was at Paris in defense of the suit, the viceroy of his own accord wrote to Napoleon III, asking him to be the arbitrator of the differences existing between the Egyptian Government and the Suez Canal Company, and the company were also invited to accept this arbitration.

"The Emperor referred the questions which had been submitted to him to a Commission, selected from the council of state, the senate, and the chamber of deputies, under the presidency of M. Thouvenel, formerly embassador at Constantinople, and former minister of foreign affairs.

"This Commission, after profound study and close investigation, declared that indemnity was due to the company for compensation, to the demands to which it had refused to submit. It appeared plainly in evidence that it had held supremely to the execution of its contract, and would prefer that execution to any indemnity. This imperial Commission proposed to indemnify the company in the following manner:

	Francs.
"1. For the retrocession of the Fresh Water Canal..... (The precise amount of the outlay made by the company as shown by the books of M. Voisin Bey, director general of the work whose accounts were laid before the Commission.)	10,000,000
"2. For the retrocession of 60,000 tillable acres of land on the banks of the Fresh Water Canal.....	30,000,000
"3. For losses caused by the withdrawal of the native laborers.....	30,000,000
"4. For the time lost by the obstacles thrown in the way of the work contrary to the concession, and for the difference in the work by machinery in place of the work by hand, a valuation in the opinion of the Commission itself less than the real loss sustained, but fixed by the Emperor not to burthen the Egyptian treasury.....	14,000,000
"Total indemnity	84,000,000

"At a later date, the viceroy wished to own the Ouady which has been purchased by the company at the public sale growing out of the succession of the late viceroy

Abbas Pasha. The Egyptian minister of finances was well satisfied with the moderate terms accepted by the company of 10,000,000 francs for a domain of 10,000 hectares, with a palace and other buildings, a domain which had been cultivated and a part of which had been already farmed out at the large revenue of 850,000 francs a year.

"Such is an exact statement of the financial relations between the Canal Company and the Egyptian Government. Now, when one alleges that the canal has ruined Egypt, it may be justly replied that it has given to Egypt the good standing which has been taken advantage of to her injury. It is sufficient to compare the state of Egypt in 1854 with its present internal prosperity and commercial movement. It would be an error to believe that Egypt ever had the transit to India and China; this was exclusively by way of the cape; and, as regards the railroad from Alexandria to Suez, its revenues have increased tenfold since the opening of the canal, and its stock is held in the first rank among the capitalists of Europe. What has oppressed the Egyptian treasury is, I repeat it, the abuse of the credit which the opening of the canal has gained for her in Europe.

"This abuse has not been caused by the expenses of the canal, which has, on the contrary furnished to Egypt:

"1. The interest of 5 per cent. on its stock since the formation of it scompany in 1858 to the present day.

"2. The 15 per cent. guaranteed by the concession from its net profits, which 15 per cent. has been pledged to the society as the land credit (credit Foncier) of France and has been held in the treasury of that society for the Egyptian Government producing a sum of 1,631,000 francs. The total of the sum of these net profits up to the expiration of the concession has been required from the Egyptian Government by different classes of creditors, and it has just been granted to indemnify the said syndicate representing 105,000,000 francs.

"It is alleged that the great European engineers, the authors of the plan of the execution of the canal, were deceived in their calculations when they fixed the cost of the canal at 200,000,000 francs. On the contrary, they were precisely correct, and the general expenses would not have exceeded their estimate but for delays and difficulties thrown in the way of the work for many years by the policy of Lord Palmerston and of the Porte, to which the viceroy of Egypt was compelled to submit.

	Francs.
"Add to the estimates of	200,000,000
"1. The indemnity awarded by the arbitration of Napoleon III	84,000,000
"2. Sale of the Ouady	10,000,000
"3. Stock issued by the company in France to cover the losses and delays created by the policy referred to, and which never could be fully estimated under the Imperial arbitration	100,000,000
"4. Redemption (Rachat) required by the viceroy for the franchise of the custom dues of Port Said, of the large buildings and property of the company at Cairo and Damietta, and of the buildings along the route of the Maritime Canal, and of which the tenants pay 5 per cent. on the costs when the company has need of their services; also, for the cession to the company of the telegraph lines, and the postal route from Port Said to Suez	30,000,000
	424,000,000

"The difference between this sum and the 457,000,000 francs which represent the real cost of the canal, including the payment of interest to its stockholders, results from the advantageous investment of its returns during the execution of its work.

"It is to be noted also that the 30,000,000 mentioned above in paragraph 4 did not come out of the Egyptian treasury, the viceroy having transferred to the public credit that amount by the surrender of his coupons of stock to the date of 1895.

"If the Egyptian finances have indeed become involved in debt, if it has become

necessary to resort to extremes in order to satisfy the creditors, the causes of the deficit must be charged to the large sums sent to Constantinople besides the annual tribute during the war between Turkey and Russia; the unfortunate war between Egypt and Abyssinia; to the multiplication of railroads and telegraph lines throughout the whole country as far as Soudan; to the extension of the distributing and irrigating canals; to the fortunate submission of the barbarous nations from the high Nile to the equator for the abolition of slavery among the blacks; to the construction of the large sugar factories in Upper Egypt, which have cost more than a hundred million francs, but which will give large remunerative profits; and finally, to the construction of the large number of public buildings and palaces and to the adornments of Cairo, &c.

"The canal of Suez has been a stranger to all these expenses. It is not to be forgotten that Egypt, by selling to England her shares of the stock of the Suez Canal Company made a profit of twenty millions of francs returned to her own treasury."

COST OF THE ORIGINAL CONSTRUCTION—IMPROVEMENTS.

Accounts of expenditure, drawn up in the same form (with one exception) yearly, have been approved by the general assembly of the shareholders, held each year from 1870 to 1884, usually in the month of June.

They comprise: First, The *Inventaire général* or capital accounts; second, the *comptes de l'exercise*, gross, net, and revenue; third, receipts or profits realized during the execution of the canal.

FIRST COST OF CONSTRUCTION.

December 31, 1869, forty-four days after the opening of the canal the cost was stated thus:

General expenses of the constitution of the company	$598,300
Cost of negotiation, commissions, &c	2,208,600
Cost of management for eleven years	2,836,505
Interest, including sinking fund	16,582,600
Services of health, domain, and transit 1868 to 1869	2,667,650
Cost of construction, including sinking fund to pay for materials	58,271,110
	83,164,765

To this sum was to be added the cost of dredging-machines, heavy plant and workshops, and material for transport service, the whole aggregating a cost of the canal works per mile of $435,340. [Too low an estimate.]

The *compte général* for December 31, 1883, contains the following items of estimated assets:

ASSETS.

Office, buildings, and furniture	$215,606
Domain	790,502
Transit and telegraph	101,679
Maintenance (materials)	1,720,232
Water service	456,729
	3,284,748

A third item of assets was:

Cash, securities in hand, and debts receivable amounting to	$11,247,295

In the *inventaire ou compte général* for each year succeeding 1869, the items of the *prix de revient*, the *actif suivant estimation*, or esti-

mated assets, and the *actif disponible ou réalisable*, or cash in hand, are severally stated, and no further distribution of the annual expenditure on capital is given. A sum is added, in each *inventaire*, to the *prix de revient*, consisting of expenses incurred for the completion, enlargement, or improvement of the canal, together with the balance of charges against the first establishment.

By December 31, 1883, the *compte général* was as follows:

Expenses as shown by the *Inventaire général* to December 31, 1882		$96,676,394
Expenses of enlargement and improvement in 1883 agreeably to the convention of 1876		395,522
Material purchased for employment upon the new works authorized by the convention of 1876		473,149
Material inutilizable, left over from the period of construction, destroyed in 1883		65,937
Total cost to date		97,611,002
The *passif* or debtor side of the account, is as follows:		
Social capital, 400,000 shares (500 francs each)		$40,000,000
Consolidated arrears of interest		6,800,000
Loan of 1867–'68		19,755,500
Loan of 1871		2,400,000
Loan of 1880		1,537,193
Various creditors		4,285,685
Reserve fund and redemption of *bons reservés*		1,309,958
Purchase of new material		181,104
Coupons not presented, and sinking fund for *délégations*		819,440
Profit and loss:		
Net profits, &c., for 1883	$7,172,708	
Paid on account	2,535,211	
		4,637,497
Difference in favor of the *actif*		30,172,089
		111,898,766

The following reports from the British directors in the Canal Company were presented to Parliament by Earl Granville, first session, 1882:

I.

PARIS, *January* 26, 1881.

MY LORD: We have the honor to lay before your lordship a return showing the amount of shipping and tonnage that has passed through the Suez Canal from the date of its opening in 1869 to the end of the past year, 1880.

This return we have placed in a tabular form to show the amounts of British vessels and tonnage as compared with those of all other flags combined. * * *

From this table it appears that in 1870 British net tonnage formed 66 per cent. of the total amount. In 1875 it had increased to 70 per cent., and in 1880 the British net tonnage formed no less than 79.5 per cent. of the total taxable tonnage passing through the canal.

* * * * * * *

We have the honor to be, &c.,

J. STOKES.
C. RIVERS WILSON.
EDW'D. J. STANTON.

II.

The British Suez Canal directors to Earl Granville.

PARIS, *February* 9, 1882.

MY LORD: We have the honor to inform your lordship that the returns of shipping in transit through the Suez Canal during the past year of 1881 show that 2,727 vessels of all nationalities passed through, having a total net tonnage of 4,136,779 tons. Of this number, 2,250 vessels belonged to Great Britain, with a net tonnage of 3,429,777 tons.

The comparative amounts for the years 1880 and 1881 were as follows:

	1880.		1881.	
	Vessels.	Net tonnage.	Vessels.	Net tonnage.
Great Britain	1,592	2,432,932	2,250	3,429,777
Other nationalities	434	624,489	477	707,002
	2,026	3,057,421	2,727	4,136,779

It will be seen from the above that the number of vessels and the tonnage of Great Britain alone in 1881 exceeded that of all nationalties together for 1880; and that in the year 1881 her net tonnage formed no less than 80 per cent. of the total amount of net tonnage passing through the canal.

With respect to the financial results of the working of the Suez Canal Company for 1881, we prefer to await the final closing of accounts before reporting on the subject to your lordship, but we may state roughly that—

	Francs.
The total receipts of the company amounted to	54,200,000
The total expenditure was	28,800,000
Leaving an excess of revenue over expenditure of	25,400,000
Which, after deducting the statutory reserve of 5 per cent	1,270,000
Leaves a net profit of	24,130,000

This net profit is superior to that of 1880 by 11,800,000 francs whereas, the expenses for both years were nearly identical.

We have, &c.,

J. STOKES.
C. RIVERS WILSON.
EDW'D J. STANTON.

The condition of the harbor and of the line of the transit was reported by the English directors in substance, as follows:

LONDON, *April* 11, 1882.

To Earl GRANVILLE:

MY LORD: We have the honor to furnish herewith three tracings of surveys of the Suez Canal and its entrance from the Mediterranean, which we think will be of interest to Her Majesty's Government.

The first is a comparative survey of soundings in front of the entrance, showing the depths in the years 1875, 1880, and 1881. * * *

It is very satisfactory to observe that the general lines of 8, 9, 10, and 11 meters in 1880 and 1881 correspond very nearly with those of 1875, and are, on the whole, rather nearer to the shore than in that year, thus affording conclusive proof that the annual dredging is most effectively keeping down the tendency to silt up at the en-

trance, which was observed in 1873, 1874, and 1875. Immediately in the channel the lines of 1881 are decidedly better than 1880.

The other two tracings are specimens of the minute and detailed surveys made every year of the canal itself, through its whole length; and show with what care are noted the accumulations of sand which require removal during the ensuing year, and the position of the revetments and their condition.

One tracing is a longitudinal section of the 29 miles of the canal, starting from Port Said; the other shows cross-sections of one bank only for a short distance.

We have, &c.,

J. STOKES.
C. RIVERS WILSON.
EDW'D J. STANTON.

This report is "Commercial No. 37, 1882."

STATUS IN 1882—SHARES PURCHASED BY ENGLAND FROM THE KHEDIVE.

The state of the capital account was, in 1882, as follows:

397,438 shares of 500 francs, or £20	£7,948,760
301,848 obligations of 500 francs, or £20 each, issued at £12, bearing interest at 5 per cent. at par, and redeemable at par	6,036,960
83,993 *délégations* of 500 francs each, bearing interest at 5 per cent	1,679,860
99,990 thirty-year bonds of 125 francs, at 8 francs per annum interest	499,950
15,152 bonds of 500 francs, at 3 per cent	303,040
399,765 *bons de coupons*, or bonds of £3 8*s.* each, bearing interest at 5 per cent., issued for the consolidation of unpaid coupons on shares, redeemable at par, which commenced November, 1882	1,335,201

Besides 100,000 founders' shares, with right to participate in surplus profit under certain conditions.

In 1882 the founders' share of surplus profits was £126,697.

Of the above 397,438 shares, 176,602 belonged formerly to the Khedive of Egypt, and were purchased from him by the British Government in November, 1875, for the sum of £3,976,582. But the Khedive, by a convention passed in 1869 between himself and the Suez Canal Company for the settlement of disputed claims and accounts, had alienated all dividends on his 176,602 shares up to 1894, and placed them at the disposal of the company. Against these dividends the company issued 120,000 *délégations*, which are entitled to all sum accruing on the above 176,602 shares up to 1894; the dividends which the *délégations* receive are, however, lessened by an annual sum laid aside to provide a sinking fund sufficient to extinguish them all by the end of the year 1894.

The statutes of the Suez Canal Company provide that all net earnings in excess of the 5 per cent. interest on the shares shall be divided as follows: 15 per cent. to the Egyptian Government, 10 per cent. to the founders' share, 2 per cent. to form an invalid fund for the employés of the company, 71 per cent. as dividend on 400,000 shares, and 2 per cent. to the managing directors.

The statement of the receipts or profits realized by the company and applied to the construction or improvement of the canal, attached to the

inventaire général of the 31st of December, 1883, is as follows (in abstract):

I.—During the Construction.

Receipts prior to the constitution of the company		$1,301
Indemnity paid by the Viceroy by award of 1864		16,800,000
Indemnity paid by convention of April 23, 1869	$6,000,000	
Less for buildings at Damietta	51,092	
		5,948,908
Produce of funds (interest)		4,020,707
Produce of sales of land:		
Cession of Wady	$2,000,000	
Fees paid	481,329	
	1,518,671	
Various lands	11,018	
		1,529,689
Sundry receipts		1,372,702
		28,673,307

II.—During the Period of Working.

Sundry receipts	498,782
Total	30,172,089

By a report of the directors, presented to Parliament July 14, 1883, it appears that the gross tonnage for the first half of that year was 4,305,882 tons, and the gross receipts for transit and pilotage duties only, 35,329,248 francs or $7,065,849. The report also states that "the rate at which the traffic through the canal is increasing allows the expectation that in June, 1885, a dividend will be distributed, making the amount of interest and dividend received by the shareholders more than 21 per cent., and that the increase of the divided profits 30, per cent., will probably take place within seven years." This unprecedented advance, while it confirms the judgment of the founders of the canal, recalls the impressive statements of Leibnitz, "that the possession of Egypt would open a prompt communication with the richest countries of the East, secure the commerce of Asia and the dominion of the world;" of Kleber, that Egypt might be for France the *point d'appui* from which she could move the four quarters of the globe; and of Buonaparte to the Directory, "by seizing and holding Egypt I retain and command the destinies of the civilized world." No country except Central America seems so happily situated for commerce as Egypt, central as she is to three continents and to the great oceans.

Corresponding statements received from United States consuls at Alexandria will be found further on in this paper, together with reports of commanding officers of United States vessels which have passed through the canal. The main history which here follows has been prepared from a personal intercourse with the officers of the company while on duty in Paris; from the "Lettres Journal et Documents of M. de

Lesseps," 5 v, 8 vo; from the "Bulletins Décadaires" of the company; and from some personal correspondence which has been courteously continued to date.

ESTIMATED SAVING OF DISTANCES.

The success of the canal was not unexpected by its founders. The French engineers, in their report to Buonaparte, in 1801, stated that the Suez Canal would save one-third of the distance and one-fifth of the time in navigating from France to India.

Lesseps in his original memoir (1856) estimated the saving between the East and West to be an average of 3,000 leagues. His tabulated estimates were as follows:

Ports.	Distance in marine leagues.		Saving in leagues.*	Calling the distance from Liverpool to Bombay, one hundred.	
	By cape.	By canal.		By cape.	By canal.
St. Petersburg	6,550	3,700	2,850	111	62½
Amsterdam	5,950	3,100	2,850	100	52
Liverpool	5,900	3,050	2,850	100	52
London	5,950	3,100	2,850	100	52
Cadiz	5,200	2,224	2,970	88	37½
Lisbon	5,350	2,500	2,850	90	42
Havre	5,800	2,824	2,976	98	48
Marseilles	5,650	2,374	3,270	95	40
Trieste	5,960	2,340	3,620	100	39½
Constantinople	6,100	1,800	4,300	103	30½
New York	6,200	3,761	2,439	104	63
New Orleans	6,450	3,724	2,726	109	63

* A league is about 3.45 miles.

The saving between England and India is stated by Admiral Richards, R. N., to be 7,620 miles; a saving in time of thirty-six days.

THE COUNTRY THROUGH WHICH THE CANAL PASSES.

The progress of this new highway of the East invites a careful inspection of its history as that of the first success of a ship-canal; the Caledonian, the earliest attempt in this direction, although a monument of Telford's engineering skill, early proving a financial failure;* and the new North Sea Canal of Amsterdam, opened in 1876, not yet having reached full success.

To appreciate the work of construction it is necessary to examine both the physical character of the two coasts at the termini and that of the narrow neck crossed by the canal, and the special difficulties encountered besides those presented by nature.

* The expenses of the Caledonia Canal have been in excess of its receipts. It was, however, constructed as a local route, out of the way of European commerce, and chiefly for the transportation of timber from Norway to the western coasts of Great Britain, a transportation interrupted by the wars of the times. Its dimensions and extreme lift of lockage places it more among inland canals, such as the Canal du Midi, or Languedoc.

A direct line across the Isthmus measures, as has been stated, about 70 miles. The chief deflection of the line of the canal from such directness is its passage through the Bitter Lakes; the two harbors, Port Said, longitude east 32° 18′ 45″, and Suez, 32° 33′ 13″ east, as already stated, differing thus but slightly from the same meridian.

The great plain of the delta is, speaking roughly, triangular; but its base towards the sea is the segment of a circle and not a straight line. The deposit which the Nile has brought down during the long course of ages causes a projection of the coast line, which in east longitude, 31° 10′, is more than half a degree in advance of the shore at Pelusium and at Marea. Like the Nile Valley, the delta is bounded on either side by hills; on the west by a range which runs northwest from Memphis to Lake Marea, and then west to the coast near Plinthiné (longitude 29°, nearly); on the east by one which has a general northeasterly direction from Cairo to Lake Serbônis and Mount Casius. The distance along the coast line from Plinthiné to Mount Casius is about 300 miles; that from the apex of the delta to the sea about a hundred miles. It is believed that the old apex was about 6 miles higher up the stream than the present point of separation, which is in latitude 30° 13′, whereas the old point of separation was about latitude 30° 8′. The entire delta is a vast alluvial plain without a natural elevation of any kind. It is intersected by numerous streams derived from the two great branches of the Nile, and has experienced in the course of time very great changes in respect of its water-courses. The general tendency has been for the water to run off more and more toward the west. The Pelusiac branch, which was originally a principal one, is now almost entirely dried up. The Tanitic and Mendesian branches have similarly disappeared. The present most easterly mouth of the Nile is the Damietta one, which was originally the fourth, as one proceeded along the coast from east to west. Even this conveys but a small proportion of the Nile water, and tends to silt up. At Rosetta there is a bar across the mouth of the river, and the Mahmoudiyeh Canal, which connects Alexandria with the Nile at Foueh, forms the only permanently navigable channel between the coast and the capital. The cause of this gradual change seems to be the current in the Mediterranean, which runs constantly from west to east along the Egyptian coast, and carries the Nile mud eastward, depositing it little by little as it goes. Port Said is continually threatened with destruction from this cause, and it is only by constant dredging that the mouth of the canal can be kept clear. (History of Ancient Egypt, Rawlinson.)

The narrow valley of the Isthmus is a depression formed by the intersection of two plains, one from Egypt and the other from Asia, across the sandy and marshy tract over which geologists have been inclined to believe that an overflow once existed, or, in other words, that the Mediterranean and Red Seas had been joined at some remote era. Some of the fauna of both have been found inland, though it has been

objected that these have never been discovered together. This separation, however, Napoleon's engineer, Lepère, accounted for by the fact that a third stream joined its waters to the others, and that the Nile had forced its way westerly to Lake Timsah, whence it had rushed north and south to join the two seas. The map of Egypt shows to-day the Nile spreading out from Cairo like the branches of a bough of a tree. The fan-shaped space included between the three points of Cairo, Alexandria, Damietta, roughly represents the produce-bearing portions of Egypt; the rest is largely desert. At the session of the Academy of Sciences, Paris, July 2, 1878, M. de Lesseps presented a piece of rock which had been dug from the soil at Chalouf, 10 meters below the sea level, in which was embedded a tooth of a shark of an extinct species, three times the size of those now found in the Red Sea. The *Bulletin des Mines* confirms the idea of the ancient union of the seas.

Along the line joining the two harbors now named, the natural depression had long indicated the way for a canal. At only two points within it are any elevations much above the level of the sea; at Serapeum, 56 feet above the mean level, and at El Guisr, 67 feet. In accordance with the explorations of M. de Lesseps, made with the Egyptian engineers, Linant Bey and Mongul Bey, in 1855, and under the concessions of the Pasha, confirmed by the Sultan, the canal has been constructed on the line which will be now briefly described:

LINE OF THE CANAL.

I. The port on the north is 30 kilometers or 18½ miles west-northwest of the site of old Pelusium. Beginning at this point the following named natural features marked out the proposed line to the projectors of the canal at their first exploration. The Bay of Pelusium presents the crescent of a shore winding from those of Northern Africa to the Syrian coast; it is protected in part from the northwest winds by the Cape of Damietta. The shore itself was found, at the point selected in 1855, moderately firm, and giving indication of a safe anchorage. It had been reached by the explorers by land from the south, the approach to it by sea having been generally considered impracticable. Nothing less promising than the aspect of the coast at that day could be conceived. Pelusium offered the shelter of a bay, but there was no water, and the whole was a series of lagoons; land and sea seemed to be blended, and the shallow shelving coast impassable. The narrow belt of land, possibly to be reached from the surf, did not exceed 150 yards in width. Behind this came Lake Menzaleh. Somewhere in the rim between these an opening was to be made for the canal, and a port and town were to be created. The explorers under Lesseps having, in 1855, waded through the lake from the south, found the belt of land as now stated and determined that the line should pass through the lake. At the point selected for the port it was found that a depth of 8 meters could be secured at a distance of but 2,300 meters off shore.

II. Lake Menzaleh formed a broad sheet of 50 leagues in circumference, having its depth dependent on the overflows of the Nile. The second stage of the canal was to be a reach of 44 kilometers south, skirting the east side of this lake, in which a depth of but 1 meter (39.37 inches) of water was found. The excavation here was at first made 7 meters deep.

III. From Kantara, a sand point jutting out from Lake Menzaleh, through the smaller and shallower Lake Ballah gave a distance of about 15 kilometers, the next reach from which was through the first elevations of the Isthmus, rising to 19 meters at El Guisr, kilometer No. 70; thence was a descent into the natural depression of Lakê Timsah, half-way across the Isthmus.

IV. From this large lake the line was across the ridge of Toussoum and Serapeum, an elevation of 7 meters above the sea level for a distance of 10 meters, and thence through the large and smaller Bitter Lakes, for a distance of 40 kilometers, from which its last reach was through a level of 20 kilometers to the village of Suez. On this last section was found a bank of very hard rock of nearly a meter in thickness. The distances in nautical miles are; Port Said to Kantara 23 miles; Kantara to Ismailia 19; Ismailia to Serapeum 8; Serapeum to Chalouf 26; Chalouf to Suez 12; total 88 nautical miles to the roadstead.

THE OUTWARD VOYAGE.

Following the line of the work, as laid down on the French maps, Kantara will be found a little in advance of the excavations through Lake Menzaleh at the 45th kilometer, about the 25th mile of the Admiralty charts; the exit from Lake Ballah a little in advance of the 16th kilometer; El Guisr at the 70th or 39th nautical mile; Ismailia, on Lake Timsah, at the 75th, the 41st nautical; Serapeum at the 90th; the exit from the line of the Bitter Lakes near Chalouf, at the 140th, the 75th English mile; and the harbor of Suez extending out beyond the 160th kilometer, the 88th geographical, or about the 100th English mile.

REVERSE OF THE LINE—SUEZ TO PORT SAID.

As the work stands to-day, ships entering the harbor of Suez pass through a wide channel protected from the sand shoals of the gulf by a mole of hard rock, and thence through the lower marshy plane of Suez for 12 miles to the deep cutting of Chalouf of 5 miles. From this point the canal then pursues its way for 75 miles, marked by a line of buoys through the Bitter Lakes—now great sheets of water 25 to 30 feet deep, but before the canal was dug wide expanses of salt marsh—whence it issues through a low tract only to encounter another stretch of higher land, through which it is conducted by the cuttings of Serapeum and Toussoum, 6 miles long; the canal thence enters the Crocodile Lake, or Timsah, once a reedy pond of brackish water, but since the uniting of

the canal with the Mediterranean, an expanse of 6 square miles of clear blue water. The highest point of the Isthmus is next reached, the "causeway" of Chalouf which is some 67 feet above the sea level; this is pierced by a deep cutting, 6 miles long, and the canal skirts the edge of one of the Ballah Lakes, cuts through a sand pit into the largest lake, issues through the sand-hills of El-Kantara ("the bridge," *i. e.*, between Asia and Africa) into Lake Menzaleh, and running for 27 miles along its east side opens out to a mouth of 1,000 feet as it enters the harbor of Port Said, on the Mediterranean coast.

Elbers, in his work on Egypt, says that to the traveler the voyage down the canal offers little of interest beyond the notice of the change from the sands of the old desert to the fruitful gardens of Ismailia, and the historic memories which the sight of the old canal of the ancients, now the Fresh-water Canal, creates, until he arrives at Suez. Port Said light-house and the quays and moles there, built at great expense by the Compagnie Lesseps, are among the greatest works of the kind. The town grows slowly, being the mere *entrepot* and coaling station for the canal. In years gone by flourishing cities and fields lined the great lakes where now dikes, brackish reedy pools, and desert tracts are all that strike the eye. Near Kantara, on the east, are the ruined towns of Tell-es-Smoot, and on the south those of Beer Migdol, on the sites of Migdol with its watch towers, erected by the Pharaohs as a protection against the Asiatic hordes. Suez, formerly a mere fishing town, has grown to be a flourishing seat of commerce.

Of the whole route, 39 miles only are in cuttings, the remainder running through a succession of lakes.

The character of the work required on the several sections of the route will appear more clearly in the history, involving, as it does, the changed appliances which became necessary from the political complications in Egypt and through English opposition at the Sublime Porte. Characterizing the work as a piece of engineering, Lieutenant-General Randall, inspector-general for the Government of India, remarks in an article prepared for the Society of Arts, London, that it would leave little to be desired had vessels been continued to be constructed of the same dimensions and lines in vogue at the time of its construction and that for thirteen years it has served thoroughly its purpose, and now may be improved to meet the wants of commerce.

The *problem* of the canal was to create a harbor on such a coast as that named; to deepen the lakes in the line—lakes which were alluvion, affected by the changes of the Nile; to fill in Lake Timsah and the Bitter Lakes; excavate through the sands, where alone the elevations reached the height of 70 feet, and through the rock from Chalouf to Suez; and, as a necessity for the work from its outset, to create a fresh-water canal for a supply to the workmen in this desert. However less formidable this problem became during the years of its solution, at the time of

the outset of the work its difficulties were pronounced insuperable by nearly all others than the projector and those into whom he infused his own confidence.

In the original determination of the line and in the inflexible adherence to his first ideas of its construction *without locks*, Lesseps, though not a professional engineer, exhibited the soundest judgment. The freedom from lockage has mainly secured financial success by securing the transit from delay.

In regard to directness, he has said that the idea of this might have occurred to a child looking on the map. It seemed a perverse arrangement of nature that a straight course should be thus blocked up, forcing the traveler a thousand miles out of his way. Yet, before his day, the creation of a direct route had never been seriously entertained, for all the traditional ideas and even the judgments of eminent engineers were adverse. The projector first took up the idea when he was quarantined in the harbor of Alexandria, in 1831, but was compelled to be content with the belief of the entire feasibility of the work, and with the cherished hope of seeing it accomplished at some far-off day. After the lapse of twenty years he brought forward his plans; twenty years further on he began to see the successful progress of an open route. For a fair judgment of the labor necessary to secure this, in opposition from the first to old but still rooted false ideas, this history is properly introduced by a somewhat detailed notice of these ideas of the past.

TRADITIONAL IDEAS AND PLANS OF A CANAL.

A Commission appointed in 1857 by the French Academy of Sciences, to examine Lesseps's first memorial on the canal question, reported in substance as follows:

The ancients did not entertain so great an idea as that of creating the route which we now propose. Their ambition was satisfied with the thought of joining the Red Sea with the Nile, which was enough to keep up commerce between Egypt and Arabia. According to Strabo, this work was begun by Sesostris, before the Trojan war, probably 1300 B. C.; but according to Herodotus, by Pharaoh Necho, son of Psam metichus, six centuries before Christ; if we may believe Herodotus, in his reign this work cost the lives of 120,000 laborers; and despite such a sacrifice Pharaoh did not open the canal; for, on consulting an oracle, he was answered, that, to carry on such a work was to labor for the Barbarians, *i. e.*, all who were not Egyptians. The oracle triumphed in that the work was not executed. It was, however, a future reproach upon it, that the Barbarians, the conquerors of Egypt, did come in by the very direction which the canal would have followed.

* * Darius,* the Persian conqueror, wished to resume the project of Pharaoh

* It is well known that Darius I conceived the bold plan of connecting the Red Sea with the Nile by a canal. The remains of a statue of the king, as well as several memorial stones covered with triplicate cuneiform inscriptions and with Egyptian hieroglyphics, which have been found near the line of the canal (north of Suez), place the fact beyond all doubt. Science has to thank the acuteness of the celebrated cuneiform decipherer, Jules Oppert, for having made the contents of these tablets ac-

Necho; he was dissuaded from it by the knowing ones (*savans*) of his day, who informed him that the Red Sea was much higher than the Mediterranean, and would, as Diodorus Siculus reported, inundate Lower Egypt, if communication with the Lower Nile were opened; but the Ptolemies, three centuries B. C., inspired by the ideas of Alexander the Great, achieved in part what the Egyptians and Persians had commenced. They continued the work.

Diodorus Siculus, B. C. 60, states that in his day a canal of communication passed from the Gulf of Pelusium into the Red Sea; it was begun by Necos and continued by Darius, but at length laid aside. Ptolemy II, however, finished the work, constructing a dam or sluice which opened to give passage and immediately closed again. The canal is said to have been wide enough for two galleys to pass abreast. The wealth of India, Persia, Arabia, and the kingdoms of Africa was brought by shipping to the Red Sea, and thence by this canal to the countries of theMediterranean. [Sir Gardiner Wilkinson cites from Diodorus the account of the vessels built by the ancient Egyptians as being of large dimensions: "One of cedar wood, dedicated by Sesostris to the God of Thebes, was 280 cubits, or 420 feet long; and the Roman Emperor Caligula in later times built in Egypt a ship to transport one of the obelisks to Rome which carried 120,000 pecks of lentils as ballast. The crew and soldiers on some ships numbered more than 7,000 persons. Cleopatra after her defeat was cut off from a retreat to India by the Arabs burning her fleet."]

After the Roman conquest of Egypt, the Emperor Adrian completed the work of the Greeks by opening up a communication between the Red Sea and the eastern branch of the Nile. * * * After the Mohammedan conquest of Egypt, A. D. 638–640, Amrou, wishing to establish a communication between the two seas, wrote to his master, the Caliph Omar, describing the vanquished territory thus: "To the most abundant harvest succeeds sudden sterility. It is thus that Egypt offers successively, Oh, Prince of the Faithful, the image of an arid and sandy desert, of a liquid and silvered plain, of a marsh covered with black and thick soil, of a green and undulating prairie, of a parterre ornamented with flowers the most varied, and of a vast field covered with a golden harvest. Blessed be the name of the Creator of so many marvels!" The caliph objected to the piercing of the Isthmus, fearing that it would open out the country to the influx of foreigners from the West. At a still later date the Mussulman, El Mansour *filled* up the canal from Suez to the Nile, in order to prevent the transportation of grain from Egypt to Mecca and Medina, which cities he thas starved into surrender. Thus was the navigable route from the Nile and the Mediterranean to the Red Sea abandoned, never to be re-established. It will be seen that the idea of the existence of a canal at any time in the past from the Mediterranean direct to the Red Sea is wholly incorrect. * * *

Napoleon appeared upon the soil which had been trod by Sesostris, Alexander, and Cæsar. He hastened to Suez to determine whether he could recommence the work of the Pharaohs. On the 30th of December, 1798, accompanied by his illustrious com-

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cessible to all by his translations. Subjoined is the translation, after Oppert, of the best preserved and clearest of the inscriptions:

"A great god is Auramazda, who created this heaven, who created this earth, who created man, who gave to man a will, who established Darius as king, who committed to King Darius so great, so [glorious] an empire.

"I am Darius, king of kings, king of lands of many tongues, king of this great earth, far and near, the son of Hystaspes, the Achæmenides.

"Says Darius, the king: 'I am a Persian; with (the power of) Persia I conquered Egypt (Mudrâya). I ordered this canal to be dug, from the river called Pirâva (the Nile), which flows in Egypt, to the sea which comes out of Persia. This canal was afterwards dug there, as I had commanded, and I said: Go and destroy half of the canal from Bira to the coast. For so was my will.'" (Brugsch's Egypt under the Pharaohs.)

rades, he rediscovered the vestiges of the ancient canals of the Ptolemies, tracked them upward of five leagues, returned to Cairo and inspected, near Baalbec, the other extremity of that canal. He gave in charge to Le Père to make a survey, adding in his charge, "Eh bien! la chose est grande; publiez une mémoire et forcez la Gouvernement Turque à trouver dans l'èxecution de ce projét, et son intêret et sa gloire." Other destinies recalled the conqueror of Egypt; the idea was abandoned, the labors of La Père gaining at that time nothing more than a place in the immortal work which is the monument of the conquest. He proposed to connect Suez with Alexandria. * * *

In 1841 M. Linant, the engineer of the Viceroy of Egypt, associated himself with Mr. Anderson, a director in the Peninsular and Oriental Company, which to-day has the English steam line through the Red Sea, in an unsuccessful effort to build up a company powerful enough to construct a great maritime canal. Five years later a second association took up M. Linant's plans and executed new and accurate preliminary levelings between Pelusium and Suez. As the result of these surveys by M. Bourdalone it was established that the mean height of the Red Sea is only about 60 to 75 centimeters (about 2½ feet) above the Mediterranean. A canal, then, without locks, a Bosphorus between those two seas, would not have, like that at Constantinople, a current always in the same direction. Under the influence of wind and tide the Red Sea will sometimes rise more than two meters above the sea level; sometimes its level will be the same with that of the Mediterranean and at others below it.

The company referred to, however, did nothing further towards the canal, but preferred to take up the railroad from Cairo. Subsequently, three distinguished engineers, Stevenson, the great English railroad founder, Negrelli, an Austrian, and Talabot proposed a canal wide and deep enough for the largest vessels. One section of this was to lead from Suez to Cairo, following nearly the route of the old canal of Ptolemy and Hadrian, and join the Nile near the *Barrage*, or Dam Saidich; the other section had its terminus at Alexandria. This plan was not, however, attempted to be carried.

This report of the French Commission assisted in opening the way for the enterprise of Lesseps, nothing having been attempted towards a canal between the date last named, 1846, and that of the report.

The problem had not escaped the attention of English engineers. In a paper read at a meeting of the Institution of Civil Engineers, London, May 20, 1851, Mr. J. Glynn, C. E., referred to the consideration, fifteen years before, of an improved means of transit from the Mediterranean to India, even to the forming of a new and direct communication by water between the seas; and stated that at that date (1836) it was decided to be most expedient and practicable to make part of the journey by canal from Alexandria to Cairo and part by land carriage from Cairo to Suez.

The advantage arising from the adoption of this route, however, led to the inference that greater benefits would result from the opening of navigation for *steamships between the two seas.*

In the year 1830 Captain Chesney, R. A., had examined the country between the Mediterranean and the Red Seas, and made a report respecting it, describing the coast and Lake Menzaleh, which is separated from the Mediterranean by a narrow strip of sandy land, "through which there are at present three openings, the ancient entrance of

Tineh being closed." Captain Chesney had summed up his report by saying:

As to the executive part, there is but one opinion. There are no serious difficulties; not a single mountain intervenes; scarcely what deserves to be called a hillock, and in the country where labor can be had without limit, and a rate infinitely below that of any other part of the world, the expense would be a moderate one for a single nation, and scarcely worth dividing between the great kingdoms of Europe, who would all be benefited by the measure.

Mr. Gwynn concluded his paper by saying:

At the present time, when a good understanding exists among the nations of Europe, and these international jealousies which prevent mutual exertion for the general good have ceased to influence men's minds, when people of all nations meet, as they are now doing, with no spirit of rivalry but with the desire to excel each other in promoting the arts of civilization and of peace, it seems to be a fitting opportunity to revive the discussion of such questions, more especially as the assistance may be hoped for of those engineers from the Continent who have carefully studied this interesting subject.

At this meeting of the civil engineers Mr. Robert Stephenson stated that he believed it would not be practicable to keep a canal open on a level cut; the canal, if ever made, would be nothing but a stagnant ditch.

It would seem clear from the discussion that while the problem of a direct route had been within the view of some as far back even as 1830, no one had distinctly avowed his full confidence in the choice of such a route or had proposed the practical means of its execution. The errors of Le Père and the anticipated political complications had probably been the chief obstacle until the correction of the former by M. Bourdalone in 1847.

M. de Lesseps was the first to avail himself of the determination of the proper level of the two seas. He had learned much from the long-continued and self-sacrificing labors of Lieutenant Waghorn, R. N., whose efforts to open a communication between his country and India are justly to be noted here. Waghorn, while on duty in the east, as early as 1827 had broached the project of such a communication by steamers, and Lord Ellenborough, then president of the Board of Control, engaged him to proceed through Egypt to Hindostan with dispatches, directing him to join the English steamer at Suez. He sailed down the Red Sea in an open boat, without chart or compass, directing his course by the sun and stars; reaching Jeddah in six and a half days, a distance of 628 miles, and proceeding by ship to Bombay, he was the more convinced of the advantages of this line of travel.

With unabated energy and perseverance, supported only by the Bombay Steam Company, he was enabled to complete the overland route three entire years before it was taken up by the British Government. He built halting places and established hotels in the desert between Cairo and Suez; he supplied carriages and vans, and placed small steamers on the canal of Alexandria and on the Nile, as well as suitable steamers on the Red Sea, working the mails to and from India by

himself from 1831 to 1834. He proposed to the Pasha the building of a railroad from Cairo to Suez, and proved a saving of thirteen days to be possible by embarking at Trieste instead of through France. The prosecution of this line, however, ruined his fortune. In one of a number of his "conferences" held by Lesseps during the progress of the canal, he says that the energy and perseverance of Waghorn had been before his mind, stimulating him to his own work. A statue of the lieutenant has been erected at Suez.

EARLY STUDIES AND LABORS OF M. DE LESSEPS.

The sketch of these which follows is presented substantially as he has given it in the *conférences* held at different times in the French cities, and from the "Lettres journal et documents pour servir à l'historie du Canal de Suez," 1854 to 1869. From 1849 to 1854 he studied everything which connected itself with commerce in any important aspect. In 1852, when these studies were being completed and he saw before him "the alternative of either gaining to his cause the pleasure-absorbed Viceroy of Egypt" or of making his application to Constantinople, he took the latter course. Old family relations of friendship* enabled him to have

* Lesseps here refers to his correspondence with M. Ruyssenaers; the consul-general of Egypt for the Netherlands, a firm friend and able helper of the enterprise. His friendship had been formed in 1832, when Lesseps had been exercising successively the offices of consular pupil, vice-consul, and consul-general at Alexandria, when the idea of a direct canal was conceived from the study of the French Commission, put into his hands by the French Consul-General Mimault. Mehemet Ali had once offered to Lesseps the advice: "Young man, if you have a good idea to prosecute, have no partners; if there are two persons it will be one too many." Following this counsel, Lesseps at the close only of the twenty years committed his secret confidentially to the consul of the Netherlands, writing to him in 1852: "I have not ceased to study, in all its aspects, the question of a canal. I confess that so long as my enterprise is thought practicable by myself alone, it will be so. It needs support, and I now ask your co-operation. I send you a memoir prepared by me as the result of my old studies, translated into Arabic. It is a confidential document. You will best judge whether the present Viceroy, Abbas-Pasha, is the man to comprehend its usefulness to Egypt, and to concur in the undertaking."

To this communication, Ruyssenaers, after an interval of four months, replied that he saw no chance of the acceptance by Abbas of the idea of cutting the Isthmus. Lesseps then returned to his farm duties till the death of the viceroy.

Of the part taken by Ruyssenaers in furthering the Suez route, Mr. de Leon, for a long time United States consul-general in Egypt, in "The Khedive's Egypt," says: "I speak of what I know, and of what many others in Egypt also know, when I assert that from the earliest inception of this enterprise before and after the concession was obtained, as well as in his constant mediation and management in all its stages, wherein his tact, temper, and influence with two successive viceroys had to be often and strongly exerted to save the scheme from utter ruin, the final success of the enterprise is as much due to him as to the indomitable pluck and energy of his better known and more fortunate colaborer, to whom the public has accorded all the glory. I mention this fact with no wish to tear one leaf from the well-earned chaplet of M. de Lesseps, one of whose earliest friends and supporters I claim to have been in act as well as profession."

the plan examined, but they brought him the reply that the solution of the question did not at all concern the Porte; it was rather the business of Egypt. He kept his ideas to himself and returned to his farm until the day of September 15, 1854, when, "busy with his carpenters and masons," the newspaper informed him of the death of the Pasha and the accession of Mohammed Said, son of Mehemet Ali. * * *

Two years before, Said had been accused of a conspiracy and had escaped to Paris, residing at a hotel where Lesseps frequently visited him. His situation at that time, the welcome he received, and the remembrances of an old friendship between the two, led to a lasting cement of his good-will. The prince was a young man of great sincerity of character, and had imbibed French ideas. When, in 1854, he came into power, Lesseps first care was to congratulate him. "He invited me," says Lesseps, "to Alexandria in the month of November. There he gave me for a residence one of his own palaces, and enlisted me as a companion on his journey across the Lybian desert with an army of 11,000 men. On that journey I had my project continually before me, but waited for a favorable moment to speak to him of it, conciliating the good-will of the officers surrounding him. His minister, Zulfikar Pasha, an intelligent man, able to comprehend the whole thing, agreed to inform me at what time I would have an opportunity of submitting my project to his master. On the 15th of November, 1854, I presented myself in the tent of the viceroy, who desired that I should return to my tent and bring a report of the project. The whole question was then set before him distinctly in the following:

MEMORANDUM ADDRESSED AT THE CAMP OF MAREA TO HIS HIGHNESS MOHAMMED SAID, VICEROY OF EGYPT AND ITS DEPENDENCIES.

The junction of the Mediterranean with the Red Sea by a navigable canal is an enterprise the usefulness of which has attracted the attention of all the great men who have either reigned over Egypt or conquered it: Sesostris Alexander, Cæsar, the Arabian conquerer Amrou, Napoleon I, and Mehemet Ali.

A canal joining the two seas by the Nile existed in ancient times under the old Egyptian dynasties for an unknown length of time; during a second period of four hundred and forty-five years, from the times of the first successors of Alexander and the Roman conquest to the fourth century before the hegira; and, again, for a third period of a hundred and thirty years after the conquest by the Arabs.

Napoleon, on his arrival in Egypt, charged a commission of engineers to examine if it were possible to re-establish and improve this route. The question was answered affirmatively, and when the savant Le Père brought in the report of the commission he said to him, "The thing is grand; it is not I that can now accomplish it, but the Turkish Government will, perhaps, some day find its glory in the execution of the project."

The moment has arrived for realizing Napoleon's prediction. The cutting of the Isthmus of Suez is certainly destined more than any other to contribute to the preservation of the Ottoman Empire, and demonstrates to those who have just been proclaiming its decline and fall that it still possesses a fruitful life, and can add a brilliant page to the history of the world's civilization.

For what reason are the Governments and the peoples of the West united in maintaining the grand seigneur in the possession of Constantinople, and why has the

power which has threatened his position met with the armed opposition of Europe? Because the passage from the Mediterranean to the Black Sea is so important that the power in Europe which should become its mistress would rule all others, and destroy the equilibrium which the whole world is interested in preserving. Let one establish at another point in the Ottoman Empire a like position and one still more important; let one make of Egypt the highway of the world's commerce by the cuttin of the Isthmus, there will be created in the East a double and impregnable situation for the great European powers; through fear that one of them will take possession of it they will regard it as a question of vital necessity to guarantee the neutrality of the new route.

Fifty years ago M. Le Père estimated that 10,000 laborers, four years' work, and from 30 to 40 millions of francs would restore the old indirect canal; he believed that a direct cutting was possible from Suez to Peluse.

M. Paulin Talabot, one of the three distinguished engineers ten years ago chosen with M. M. Stephenson and Negrelli by a society for the study of a canal for the two seas, adopted the indirect route from Alexandria to Suez, availing of the barrage of the Nile. The total expense was to be 130,000,000 for the canal and 20,000,000 for the port and roadstead of Suez.

M. Linant Bey, who has for thirty years directed skillfully the canal works of Egypt, who has made on the ground the question of a canal the study of his whole life, has proposed to cut the Isthmus by nearly direct line across its narrowest section, establishing a large interior harbor in the basin of Lake Timsah, and making the entrances at Peluse and Shez approachable by the largest ships.

M. Mougel Bey, director of the works of the Nile barrage and chief engineer of the Ponts et Chaussées, also discussed with Mohammed Ali the possibility and usefulness of cutting the Isthmus; and in 1840, at the request of Count Walewski, then on a mission to Egypt, was ordered to make the preliminary steps in Europe. Political events prevented the carrying of them forward.

A close investigation will determine which one of these routes is the best, and the enterprise being recognized as practicable we have only to choose the best. All the necessary operations, however difficult, involve nothing discouraging to modern skill; their success cannot to-day be placed in doubt. It is a question of money, which the spirit of enterprise and of association cannot fail to resolve if the resulting profits justify the outlay. It is easy to demonstrate that the cost of the Suez Canal, admitting for it the highest figures, is not out of proportion to the utility and the profits of this important work, which would curtail by more than one-half the distance of India from the principal countries of Europe and America. This result is made obvious in the following table, drawn up by M. Cordier, professor of geology. [Here followed the table of the saving of distances given on page 19 of this report.]

With such figures before us comment is useless. They show that all the nations of Europe, and even the United States of America, are alike interested in the opening of the Canal of Suez, as well as in the rigorous and inviolable neutrality of that thoroughfare.

Mohammed Said clearly comprehends that there is no undertaking within his power which, from its immensity and the utility of its results, could bear comparison with that which I propose to him. What a splendid title to fame for him! What an everlasting source of wealth for Egypt!

The pilgrimage to Mecca henceforth assured and facilitated to all Mussulmans; an immense impulse given to steam navigation and to distant voyages; the countries on the coasts of the Red Sea and the Gulf of Persia; the eastern coast of Africa, India, the Kingdom of Siam, Cochin China, Japan; the vast empire of China, with its more than 300,000,000 of inhabitants; the Phillipine Islands, Australia, and that immense archipelago toward which the emigration from old Europe is directed, brought nearer by nearly 3,000 leagues to the Mediterranean Sea and the North of Europe; such are the sudden and immediate effects of cutting through the Isthmus of Suez.

It has been calculated that the European and American navigation via the Cape of Good Hope and via Cape Horn may carry on a yearly traffic of 6,000,000 tons, and on the half only of that tonnage the world's commerce would realize a benefit of 150,000,000 francs annually by sending the ships via the Gulf of Arabia. There is no doubt that the Canal of Suez will occasion a considerable increase of tonnage, but in reckoning only upon 3,000,000 tons there will yet be an annual produce of 30,000,000 francs, by collecting dues of 10 francs per ton, which might be reduced in proportion to the increase of navigation.

Having indicated the financial advantages of the undertaking let us consider its general political advantages, which we believe to be equally incontestable.

Everything that results in contributing to the extension of commerce, of the industry, and of the navigation of the world is especially advantageous to England, a power which stands foremost amongst all others from the importance of its navy, from the productions of its manufactories, and from its commercial relations.

A deplorable prejudice, based upon the political antagonism which so long and so unhappily existed between France and England, has alone accredited the opinion that the opening of the Canal of Suez, so useful for the interests of civilization and of the common weal, could damage those of England. The alliance of the two nations which rank highest in the scale of civilization, an alliance which has already proved the possibility of solutions hitherto reckoned impossible by vulgar tradition, will, amongst its other numerous benefits, allow us to investigate with impartiality this mighty question of the Canal of Suez, to form an exact estimate of its influence upon the prosperity of nations, and to consider it heresy to believe that an undertaking calculated to halve the distance between the Western and Eastern hemispheres of the globe should not be suitable for Great Britain, the mistress of Gibraltar, Malta, the Ionian Islands. Aden, important stations on the east coast of Africa, India, Singapore, and Australia.

England, as well as France, and even more, must wish to see a cutting through that strip of land of 30 leagues, which no one who pays attention to the subject of civilization and progress can behold upon the map without feeling the most ardent wish for the disappearance of that only obstacle which Providence has left in the highway of the world's traffic.

The railway by itself is not sufficient; it will never acquire any substantial importance, and will only be assured of its revenues when it has become the auxiliary of the maritime Canal of Suez. The completion of the railway, so useful to travelers, and so justly desired by England, will then become a necessity, and will no longer be a heavy charge upon the Egyptian Government.

Germany will also hail all the efforts for the construction of the canal across the Isthmus. It will be to her the complement to the free navigation of the Danube. Prince Metternich, who for more than twenty years has interested himself in the cutting of the canal of the two seas, and Baron de Bruck, one of the promoters of the investigations made in 1847, saw that in this question lay the aggrandizement of Trieste and of Venice, as well as the opening of important outlets for the produce of the imperial provinces and of the Kingdom of Hungary, where the projected canal from the Danube to Kustendge, on the Black Sea, in the line of the ancient trench or rampart of Trajan, will facilitate exportation.

Russia will find in the opening of the Canal of Suez a just satisfaction of that national aspiration towards the East which led her on one occasion to extend the limits of her vast empire to the confines of British India, and on another to threaten the integrity of Turkey.

The mission of civilization devolving upon the Czar over the numerous tribes of whom he is arbiter, may yet suffice the noblest ambition; the new outlets which will be pacifically thrown open to their activity and to the necessity of expansion will be more profitable to them than a policy of conquest and exclusive dominion, which it is now no longer possible for any one nation to carry on triumphantly.

The United States of America, whose traffic with Indo-China and Australia has for many years immensely developed itself; Spain, with the Phillipine Islands; Holland, with Java, Sumatra, and Borneo; the towns formerly so flourishing on the coasts of Italy; the ports and islands of Greece; all the nations, in short, which have held or hold a high maritime and commercial position, will hasten to take part in a work which will augment their wealth, or create new sources of it, and to the success of which I believe I can promise his highness, Mohammed Said, the active and energetic co-operation of the enlightened men of all countries. (Lettres, Journal, et Documents, Vol. I, pp. 20–25.)

Said Pasha read this memorial to his officers, translating it into Turkish as he read. These counselors (*improvisés*), more fitted, says the projector of the route, to decide on the question of an equestrian performance than upon an enterprise whose bearings they could scarcely comprehend, opened their large eyes upon him to let him understand that the friend and guest of their master, whom, just before their assembling, they had seen leap on his horse over the parapet of the camp,* could not offer other than good advice. As the viceroy went on with his reading, from time to time they raised the hand to the head in token of approval of all he said.

Zulfikar Pacha congratulated Lesseps on his success, and furnished a courier to bear letters of the good news to France. Said Pasha doubtless had seized upon what he thought would signalize the reign on which he had entered. The concession was virtually made. The incident of the day had its effect on the Eastern mind in securing what bore to it no conceivable proportion.

EXPLORATION OF THE ISTHMUS.

On the 24th of December following (1854), two French engineers, long domiciled in Egypt, Mougel Bey and Linant Bey, accompanied Lesseps on an expedition through the Isthmus to explore for a route between Suez and Pelusium. Their exploration was finished January 15, 1855. On their setting out, a series of close inquiries had been laid before the engineers, embracing nearly all the chief points of the real or alleged difficulties in the way of the work, including the selection of the port on the north, the line of route, the opening of a lateral canal from the Nile, the dimensions of the main cutting, and the *maximum* of cost and the *minimum* of revenue. Not a line appears as to an inquiry for the number or dimensions of any locks. The two engineers rejected in their report any line other than a direct one from sea to sea, and on their presenting to the viceroy a favorable estimate, Lesseps prepared to visit Constantinople. Said was favorably impressed. He furnished

* The viceroy and the officers had been charmed with a daring leap of Lesseps on the Arab charger which had been presented to him. In connection with other circumstances at this hour it went far to secure a favorable reply to the proposition submitted. Said had already committed himself by the few words: "I am convinced. I accept your plan. We will consider the means for its execution, during the rest of our journey. It is a matter well understood. You may rely upon me."

the projector with a strong letter to the vizier, Reschid Pasha. He had committed himself, also, to more than a verbal promise of support, for he had said, in reply to the objections raised already by some of the consuls, "If, when the work is to be begun, the first needed capital is not available, I will furnish it from my own funds."

THE FIRST CONCESSION.

Parliamentary paper No. 6, 1876, furnishes the details of the concessions in favor of the enterprise. The first of these was officially signed by the viceroy on the day of an audience with the resident foreign representatives on this subject, November 30, 1854. Its opening paragraph read thus:

> Our friend, M. Ferdinand Lesseps, having called our attention to the advantages which would result from the junction of the Mediterranean Sea with the Red Sea by a passage navigable by large vessels, and having shown to us the possibility of constituting a company of capitalists of all nations for this purpose, we have accepted the combinations he has submitted to us, and have given him by these presents exclusive power of constituting and directing a universal company for cutting through the Isthmus of Suez and establishing a canal between the two seas, with power to undertake or cause to be undertaken all works and constructions, the company being charged with the indemnifying private individuals in case of appropriation for public use.

The most important points of this first concession, besides the exclusiveness of the right of way, were:

1. That the director of the company was to be always named by the Egyptian Government, chosen, as far as possible, from amongst the shareholders *most interested* in the undertaking.

2. That the duration of the concession was to be for ninety-nine years from the date of the opening of the canal throughout.

3. That the Government reserved to itself the power to erect any fortifications it pleased in the neighborhood.

4. That the Egyptian Government was to receive, yearly, 15 per cent. of the net profits shown in the balance sheet of the company, without prejudice to any dividends belonging to the shares which the Government reserves a right to take on its own account, and without any guarantee on its part.

5. That the rest of the profits were to be divided as follows: 75 per cent. for the benefit of the company; 10 per cent. for the benefit of the original promoters.

6. That, on the expiration of the concession, the Government was to succeed to the company, enjoy all its rights, and enter into full possession of the canal.

7. That no alterations could be made in the statutes of the company without receiving the previous approbation of the viceroy.

That permission from the suzerain of Egypt should be so promptly accorded for creating a work involving such grave political and com-

mercial bearings can be accounted for only on the grounds of the brilliant expectation set before the mind of the suzerain that the enterprise would mark a new era for his reign in Egypt; to which must be added the early friendship which has been named and the fortuitous hour seized upon by Lesseps for presenting his plan. The incident of the feat of horsemanship helped to gain the favor of those surrounding the viceroy. Mr. Fitzgerald, in his Canal of Suez, says of this:

The little incident has been ridiculed in some of the newspapers, the turn given to it being, "that he had gained his concession by leaping his horse over a wall." He knew what was most likely to impress the Eastern mind, and, as it will be seen later, all through his course he neglected *nothing* that might assist his plans.

FIRST INTERVIEW WITH THE PRIME VIZIER.

Arriving at Constantinople February 15, 1855, Lesseps was accorded a conference of two hours, at which he gave to the minister with his letter from Said Pasha a Turkish translation of his Memoir on the Junction of the Two Seas, and a copy of the concession. The pasha had previously written favorably to the Porte. The prime minister himself appeared favorably impressed; but in the interview was well advised by Lesseps of his own knowledge of the opposition, not only of England, but of its representative, Sir Stratford de Redcliffe. The overpowering influence of the representative constrained every favorable impression upon the Porte and every assistance which the other representatives were disposed to give. After laying before the vizier a letter from the divan, Lesseps returned from Constantinople, satisfied that his delays at that city called for more promising labor elsewhere. On the 26th of February the Sultan's advisers, called together at the request of the Viceroy of Egypt, had seemed willing to give their sanction to the great work; but they had been entirely overruled by the influence of Lord Stratford.

Before leaving Constantinople he forwarded to Schefer, first dragoman of the French resident embassy, extracts from Arabic authors who had written on the old canal, desiring the dragoman to have these laid before Reschid Pasha and the other members of the Turkish cabinet. In his extract from El Macryzy he found the statement:

When the Most High gave Islamism to men, and Amrou conquered Egypt, he busied himself in the work of restoring the old canal and conducted it to the Sea of Quotzum, from which ships could sail to Hedjas, Yemén, and India. It remained open until the revolt of the City of the Prophet against El Mansour, the Calif of Irak, who filled it up to cut off supplies from the city Medina.

From Tott's Memoirs of the Turks Lesseps quoted a statement of the great interest afterward shown by the Sultan Mustapha in the project for re-opening communication between the two seas, adding to this statement from Tott:

Among the different works which have been the glory of ancient Egypt this canal would deserve the first place if the efforts of genius for promoting public utility were

sustained by the generations whose destiny it was to enjoy them and if the foundations of the public good could secure the same solidity as the prejudices which overthrew it. But in place of this history offers little more than tables of the existence of the nations—tables of the ages. But for these continual *destructions* Egypt's happiest position would have given it to her to dictate immutable laws; the canal of the Red Sea would have been the basis of the public law of the nations.

Contenting himself with the transmission of a number of letters to the foreign representatives, Lesseps found himself again in Egypt, and on the further study of the question with the Pasha decided to present it in all points to

AN INTERNATIONAL COMMISSION OF ENGINEERS.

It may seem strange that additional reason for this was found in the opposition still manifesting itself even in *France* among the partisans of the old *indirect* line. Lesseps found that he must oppose on this point scientific men of high distinction for success. He "would reply to science by science." He wrote to the principal foreign ministers asking that they would name engineers of high rank, and would secure their uniting in a commission to examine the routes.

Austria sent M. de Negrelli; Italy, M. Paléocapa; Spain sent M. Montesino; Holland, M. Conrad, director-general of the water-works; and Prussia, M. Lentze, by Humboldt's advice. There was then no body of civil engineers in England. Lesseps went over and invited Messrs. Rendel, Manby, and McLean, civil engineers of London; France gave him M. Renaud, inspector-general of the ponts et chaussées, Admiral Rigault de Genouilley M. Lieussou, hydrographer of the navy. These gentlemen had their first meeting at Lesseps's office in Paris October 11, 1855. "They came in punctually at the same hour by railway from Madrid, Amsterdam, Berlin, and London, and after mutual introductions held their first session, at the close of which no one could doubt of the success of my enterprise. They declined unanimously to receive the expenses of this visit."

They named as a subcommission Messrs. Conrad, Negrelli, Renaud, McLean, and Lieussou to prosecute the study on the ground of the proposed route. All the members proceeding to Egypt were received cordially by the pasha, who placed at their command his boats and railroads, defraying from his own purse the whole expense of the exploration—300,000 francs.

In a preliminary report presented to Said Pasha, dated Alexandria, January 2, 1856, the Commission rejected the plan for an indirect canal from Alexandria as "inadmissible from a technical and an economical point of view." They reported that the direct route offered every facility for execution, and the harbors to be created no other than the usual difficulties, the port of Suez opening upon a large and safe roadstead, and the port on the Mediterranean also offering a good anchorage.

The estimated expense of the work was 200,000,000 francs. The report closed with the statement :

> The direct canal is the solution of the problem of the junction of the two seas. Its execution will be easy and its success assured. Our conviction is unanimous that its results will be immense upon the world's commerce.

The Edinburgh Review, the alleged organ of Lord Palmerston, had already denounced the practicability and usefulness of a canal. As the result of the favorable report of the International Commission, Lesseps asked and received from the viceroy a renewal of the concession made two years before, and laid before him the proposed statutes of the company he expected to form for the prosecution of the work.

The second concession, dated January 15, 1856, was an amplification of the first one, explaining in more detail the nature of the charges and concessions. The terms of this concession were designed to satisfy the opposition which had already begun in England and to guarantee fair returns to the stockholders who might invest. England being disquieted by the idea of the large number of European workmen who would be gathered for the work, the new act provided that at least four-fifths of the number employed should be Egyptians. Doubts having been set forth whether the canal could ever give passage to large ships, the act provided that the canal should be of the dimensions fixed by the International Commission, and that Lake Timsah should be converted into an interior harbor to receive vessels of the largest tonnage; and to quiet the fears as to the returns for the benefit of stockholders Mohammed Said granted a new source of profit by the concession to the company of all the uncultivated land, not private property, which should be watered and cultivated by its care, these lands to be free from tribute for ten years.

The viceroy made an official declaration for himself and his successors, subject to the ratification of the Sultan, that the canal and all its ports should be open at all times as a neutral highway to every merchant ship passing from one sea to another, without any exclusive distinction or preference of persons or nationalities.

The statutes which were to govern the company now to be formed fixed its capital stock at 200,000,000 francs, say 400,000 shares of 500 francs each. The company would have for its objects the construction of a ship-canal of full communication between the two seas, from Suez to the Gulf of Peluse, of a canal of river navigation from Cairo to Lake Timsah, and of two canals joining this from its mouth at the lake and leading to Suez and to Peluse, together with the improvement of these works and their necessary adjuncts and of the conceded lands.

The company secured the rights for ninety-nine years, counting from the day of the opening of the canal, to take from the mines and quarries of the public domain all the material necessary for the construction of the works and their maintenance.

The chief rights of the company for the period named were thus defined:

For indemnifying the expenses of construction, maintenance, and improvement, the collection of the dues from navigation, pilotage, towing and wharfage, according to a tariff to be modified from time to time, said tariff to be made public in the great harbors of the nations three months before its application; the chief right of navigation not to exceed 10 francs per ton of capacity of ships and per head of passengers.

The statutes of the company marked out its name, its period of existence in the formation of its social capital, the composition of the council of administration and of its Committee of Direction, the meeting of the stockholders in the Assemblées Générales, &c.

The net profits or benefits of the enterprise were to be apportioned in the following manner: 15 per cent. to the Egyptian Government, 10 per cent. to the founders, 3 per cent. to the directors, 2 per. cent. for a reserved fund for pensions and other benefits, and 70 per cent. as a dividend for the stockholders in general.

PREPARATORY WORK.

It was at once decided to commence this by digging two small channels which should mark the two sides of the canal. The earth between these was to be taken out by the contingent of the fellahleen which the Egyptian Government engaged to provide. The pay of these and their rations was fixed by a contract in which Lesseps bound himself to furnish quarters for them, and in case of sickness or wounds to receive them without cost into the hospitals, provide medical attendance and half pay. They were not called to the work until their harvest had passed.

The work was further begun at two points, the one the marking out the lines of the Fresh-water Canal, the other the further exploration for the new port, Captain Philigret being ordered to anchor his ship, the Yandbeker, in the waters off Peluse for such exploration. M. de Lesseps, with his son Charles and M. Barthelemy St. Hilaire, went forward to examine the desolate shore, and other explorers visited Suez.

After passing four months on board the Egyptian corvette (from January to April, 1857), Philigret reported that the conditions of the proposed harbor of Said were favorable for getting under way, approach, or anchorage; and the Academy of Sciences having examined the journal and log certified to the good character of the point.

At Suez a depth of 8 meters was found at a distance of 1,800 off shore. The English Government sent out a vessel to verify the report of Captain Philigret. About the same time the Governments of Holland, of Austria, Sardinia, and the Popedom appointed commissions to investigate the problem which was thus brought so prominently before them.

LESSEPS' VISIT TO ENGLAND.

The original memoir on the canal was translated and put before the English people, and, after fighting the diplomatists and other enemies of the canal at Paris for some months, the projector made his first visit with it to England. All the great powers had, at that time, representatives at the Paris Conference, engaged on the treaty which closed the Crimean war; he held the hope that as England was alone in the opposition to the canal, a declaration in its favor might be obtained from the others. Yet Count Buol had to tell him that "though assured of the support of the French, Russian, Sardinian and, Prussian ministers, he thought it best not to bring the matter before the Conference." Prince Metternich alone had given him a warm and cordial indorsement.

In London, Lesseps was presented to the Queen, had a long conversation with Prince Albert, and was entertained by the Royal Geographical Society. His first interview with Lord Palmerston may be represented by two or three sentences of the reply from the premier, that "all the engineers of Europe might say what they pleased; he knew more than they did, his opinion would never change one jot, and he would oppose the work to the very end."

In the mean time the viceroy himself was growing disheartened by the opposition, the English embassy at Constantinople even sowing distrust between him and the Sultan. Lesseps hastened to Cairo. The pasha there told him that attempts had been made to tamper with his troops whose officers were Turks; he could no longer resist the intrigues and harassments. The relief for this was accepted in a proposition to take a joint excursion to Khartoum, on which expedition of three months, on which part of their time was given to the project; with Conrad, the Dutch engineer; the ground for the Fresh-water Canal was surveyed and four hundred workmen set to work.

But the ratification of the Sultan required by the concession of the pasha was yet delayed. The projector, therefore, determined to return to England and appeal to the people, "believing that a great commercial nation would give their sympathy even in opposition to their rulers." With Sir Daniel Lange, he was received most cordially at Liverpool, the mayor undertaking all expenses; and he held more than twenty meetings in the most important cities of the kingdom. At their close, being present by invitation at one of Lady Palmerston's soirées when the premier said to him "You know that I am utterly opposed to your scheme," Lesseps replied, "I look to your opposition as an engine for raising the capital, and if I had 100,000 francs to offer you and you were the kind of person that would accept, I would cheerfully give them for every speech made against the canal."

To a question raised in the House of Commons as to whether the Government would not use its influence with the Sultan, Palmerston re-

plied that "for many years it had been doing its best to oppose the scheme of that court;" adding that the political tendency of the enterprise was obvious—to render more easy the separation of Egypt from Turkey. The premier seems to have been ever-mindful of the old fashioned French policy, that French influence was to be supreme in Egypt, Napoleon having at one time said that the possession of Egypt would convert the Mediterranean into a French lake. Mr. Stephenson, the engineer, supported Lord Palmerston's additional declaration that the scheme was physically impracticable, except at an expense too great to warrant any expectation of returns.

The opposition of the Government continued to be as persistent throughout the two following years. In Parliament March 26, 1858, on Mr. D'Israeli being asked whether it was desirable that this should continue, now that all the other nations were in favor of the canal, replied that it was a most futile attempt, impossible of execution and; on Mr. Roebuck's motion, June 1, that the power and influence of the country should not be employed in obliging the Sultan to withhold his assent, Stephenson again opposed the work as "physically impossible."

Mr. Gladstone endorsed Mr. Roebuck's motion. He refuted the theory that it would lead to the dismemberment of the Turkish empire, whose power, he maintained, would not be affected by a canal or anything of the kind. With great force he argued that the advantages of the canal would be all for England, that country which already by means of Aden and Perim controlled the Red Sea. "Which of the powers," he asked, "will it be who will really hold this canal when it is opened? Must it not of necessity fall under the control of the first maritime nation of Europe? England, and no other country will be mistress of the canal." But although he added "there is not a statesman in Europe who does not denounce the policy of this opposition as unwarrantable and selfish," Mr. Roebuck's motion, supported only by a few strong voices, and countenanced by a call from Mr. Bright for the correspondence of the Turkish Government, was rejected by a vote of 228 in a house of 290 members.

Yet the discussion in Parliament produced a movement in favor of the enterprise not only in France, but generally throughout the continent. At the Porte an unfortunate expression from Lord Malmesbury, that the English Government had welcomed with satisfaction the declaration of Turkey, that it would take no step without the approbation of England, caused some astonishment at the divan and was offensive to the French emperor. The recall of Lord Stratford de Redcliffe carried a more moderate policy to Constantinople; and the ministers of the various powers having shown more openly their indorsement of the scheme, the advice of Prince Metternich and of the French emperor was now fully accepted, that a company should be organized and the money subscribed. This would become a force that could not easily be resisted. The words of Louis Napoleon—himself the advocate of an Isthmus canal

in America—had been in an early interview with Lesseps, "You were right in not drawing the various governments into your plans, and will do well to keep that policy. Were I to support you now, it would amount to *war with England*, but once you have all the capitalists of Europe engaged, then every one will come forward to support you and I myself will be the first." Prince Jerome and Eugenie were, throughout, zealous friends.

The interval of time between the meetings held throughout England and the date of August, 1858, had been closely occupied by the projector in making use of the favorable receptions he had there met with, as a counterbalance on the minds of Reschid Pasha and his successor at Constantinople; keep up the good will of the viceroy; and in the holding of "conférences" in different countries. Within the four years from the date of the concession Lesseps had traveled each year 10,000 leagues. December 26, 1858, notice was duly addressed to M. Rouher, the minister of public works, announcing that the company had been constituted.

The organization was made under the concession of the pasha only, renewed and extended two years before. No firman had been granted, nor was it issued until the late date of 1866. Some authority from Constantinople, however, could be shown in a letter from the vizier, with other like messages to the pasha, congratulating him on the enterprise as beneficial to the empire, and in declarations from Aali Pasha and Fuad Pasha that the Sultan would not himself offer any obstacle. The viceroy was informed how the company had been constituted and that subscriptions having been made, they were ready to begin the work.

Prince Jerome Napoleon was appointed "protector." The title of the association was "The Universal Company of the Maritime Canal of Suez." The plan originally adopted was to secure the freest subscriptions from the largest number of investors.

Of the 200,000,000 divided into 400,000 shares of 500 francs each, 207,111 were taken in France alone; many subscribers taking a single share even. The Viceroy subscribed for 177,642 shares. A few subscriptions were made in Austria and Holland. From the United States no replies were received. Lesseps had held a courteous correspondence on the subject of the canal with the United States consul. The following letter appears also in this connection:

CONSTANTINOPLE, *January* 22, 1858.

Mr. Brown, chargé d'affaires of the United States of America, has told me that if he had known that the English Government had taken any positive step with the Porte in opposition to the cutting of the Isthmus of Suez, undertaken by a commercial company for the benefit of all nations, he would have considered it his duty to have sent to the divan a written protestation in the name of his Government, whose intervention is an accorded right in every question which involves the defense of the freedom of the seas. * * *

F. DE LESSEPS.

A. M. THOUVENEL.

Lesseps had addressed the President of the United States:

[From lettres, journal, et documents.]

(Private.)

PARIS, *October* 21, 1857.

SIR: The Honorable Representative of the United States at Alexandria has shown the most favorable disposition, in his own name and that of his Government, towards the enterprise of cutting the Isthmus of Suez.

This consideration and my friendly relations with the United States, where many of my relatives have become citizens, justify me in commending to you specially the official letter which to-day I have the honor to address to you on the present situation of the enterprise of the Suez Canal, which will shorten by more than 2,800 leagues the maritime distance from Bombay to New Orleans, Boston, and New York.

The liberal and generous policy of the American Union has always defended the freedom of the seas, and if any one other selfish and exclusive policy should show itself to obstruct the free communication between the Mediterranean and the Indian Sea, the principle of the freedom of the sea would receive serious injury. In that case the intervention of the agent of the United States at Constantinople would be perfectly justifiable, aside from motives of national interest concerning the commerce and navigation of the Union.

Besides this, the execution of the canal of the two seas, which one day will be the most useful auxiliary of the American canal of the two oceans, will give at a future day to the United States the occasion and the right of intervention in the counsels of European diplomacy to effect, with the concurrence of France, this inevitable solution.

*The respect of private property on the seas and the abolition of the blockade of commercial ports, extending over commerce from the enemy the legislation which already governs the commerce of neutrals.**

FERDINAND DE LESSEPS.

Lesseps had written to the Chamber of Commerce in England:

I have informed you sincerely and without any concealment of my views and plans in the pursuit of an enterprise which is essentially and exclusively commercial. I have replied to every question, I have furnished every desired explanation, and you have appreciated these and have given your sanction to the work with all the mature judgment and experience which distinguish you. But the enterprise, in spite of its guarantees of universality and neutrality, has seemed to alarm some of the statesmen of your country in a political point of view. From this, incidents have occurred which have tended to hinder the progress of the company. I hasten to inform you that it maintains its rights and effectually defends the important interests which it represents.

While giving you this assurance, I deem it proper to declare at the same time that I earnestly desire the establishment of a unanimous cordiality of agreement on the subject of an enterprise conceived, not with a view to the interest of any selfish nationality, but for the development of commerce and the extension of civilization throughout the world.

The subscribers to this capital stock were to receive from the date of their subscription interest of 5 per cent. on their investments. This was in accord with the invariable usage in France, for investments in the state securities drew interest from date, and something at least equally promising was necessarily to be offered on the part of the canal. The subscription was closed within less than two months from the date

* The italics are those of M. de Lesseps. No reply to this letter has been found.—J. E. N.

of its opening. This ready placing of the stock for a distant, and in some instances unknown, location of a new enterprise owed its rapid success not to the activity of bankers and agents, but largely to French feeling stirred by the opposition of the English Government. As regards the employment of bankers as agents, Lesseps relates the substance of an interview with the well-known house of Messrs. Rothschild. He had rendered some services to this house when minister at Madrid. "If you desire it," says M. Rothschild, "I will open a subscription in my branches." "And what would be the expense?" said I, delighted. "Oh, I see you are not a business man; it is always 5 per cent." "Five per cent. on 200,000,000 is 10,000,000 francs. I will rent an office for 1,200, and will take charge of the matter myself."

The Grand-Central, which had just removed from the Place Vendôme, gave room for the office of administration, where subscriptions soon freely arrived. Among the lesser incidents of the subscription, the "Lettres" give us the following dialogue: "Two applicants came to subscribe, one a bald-headed priest, but doubtless formerly a soldier, who said, 'These * * * English, I am delighted to be revenged on them by taking stock in the Suez Canal.' The other applicant, a well-dressed gentleman, wished to subscribe to the new railroad in the island of Sweden. 'But I must tell you it is not a railroad, but a canal. It is not on an island, but an isthmus. It is not in Sweden, but Suez.' 'It is all the same,' he replied, 'so that it is against the English, I subscribe.'"

This feeling was, however, rather against Lord Palmerston and his supporters, for at this period of the Crimean war personal relations were rather friendly on both sides of the channel.

In the endeavor to show the futility of political apprehension Lesseps had forwarded and published the following letter to Sir Stratford de Redcliffe, at Constantinople:

There are questions which require to be frankly approached in order that they may be fairly resolved, as wounds or maladies have to be discovered before they can be cured. The kindness with which you have received my first observations in regard to a subject the gravity of which cannot be disguised encourages me to submit to you the question of the Suez Canal from a point of view in which, I think, the matter may be very usefully discussed. The influence which your high character and long experience naturally give you in the decisions of your Government relative to all Oriental questions makes me anxious to neglect nothing that might aid you in forming an opinion with full knowledge of the facts.

The results already attained through the ultimate alliance of France and England sufficiently prove how advantageous is this unison of the two nations to the interests of the equilibrium of Europe and of civilization. The future happiness of all the nations of the world is involved in this state of things, which, to the everlasting honor of the Governments that have thus far maintained it, can alone guarantee to mankind the benefits of peace and progress. Hence the necessity of removing in advance every cause of rupture, and even of coolness, between the two nations; hence the imperious duty of examining among possible contingencies what circumstances are of a nature to awaken antagonistic feelings and provoke among either people those emotions against which the wisdom of Governments is powerless to

strive. The motives of a hostile rivalry tend successively to give place to that generous emulation which produces grand achievements.

In considering the situation in a general way, however, one fails to perceive on what grounds or what occasion those struggles which deluged the world with blood could begin again. Can financial or commercial interests divide the two nations? But the capital of Great Britain thrown into so many French enterprises and the immediate development which international commerce has made, will establish bonds between them which become closer every day. Are political interests or the questions of principle likely to awaken strife? But the two nations have now but one single object—one single ambition—the triumph of right over might, of civilization over barbarism. Finally, will paltry jealousies in regard to territorial extension divide them? But to-day they understand that the globe is vast enough to present to their respective populations domains to be reclaimed and human creatures to be reclaimed from barbarism, and that whenever their flags are together, the conquests of the one enhance the profits of the other.

At the first glance, therefore, it is difficult to detect anything in the general situation that could alter our beneficial relations with England.

Nevertheless, upon a more careful scrutiny, an eventuality presents itself which, by making the two most enlightened and moderate cabinets of Europe partake of popular prejudices and passions, is capable of reviving old antipathies, and compromising, with the alliance, all the old bonds of amity which united the peoples. There is, in fact, a certain point upon the globe the freedom and neutrality of which is intimately connected with the political and commercial power of Great Britain—a point which, in times gone by, France, on her part, has desired to become possessed of. That point is Egypt, the direct path from Egypt to the Indies—Egypt, sprinkled so many times with the blood of Frenchmen.

It would be superfluous to review the motives which would actuate England in preventing Egypt from falling into the hands of a rival nation. But we must also carefully note that, with interests less positive, France, under the empire of her glorious traditions, under the impulse of other sentiments, instructive rather than critical, and for that reason all powerful in the mind of her sensitive people—would never leave England in the peaceable possession of Egypt. It is, therefore, that so long as the route to the Indies is open and secure, and that the condition of the country guarantees facility and promptitude of communication, England will never attempt to create grave difficulties by appropriating a territory which has really no other value to her than as a place of transit. It is equally evident that France, whose policy for the last fifty years has consisted in contributing to the prosperity of Egypt as much by her counsels as by the co-operation of a large number of distinguished Frenchmen in Egyptian affairs, in science, in administration, and in all the arts of peace or war, will never attempt to realize the project of an epoch now passed away, so long as England keeps her foot from the country.

But supposing that one of those crises which so frequently disturb the East should happen, or that England should think herself obliged by circumstances to take possession of Egypt in order to prevent another from seizing it, let us inquire whether it is possible that the alliance would resist the complication which such an event would produce? What reasons would England have for believing herself forced to become mistress of Egypt at the risk of breaking her friendly relations with France? Solely on this account: That Egypt is the shortest and most direct route from England to her Oriental possessions; that this road must be constantly open, and that she can make no terms with anything that touches this transcendent interest. Therefore, by her natural position, Egypt may be the cause of a conflict between France and Great Britain; and yet the chances of rupture would disappear if, by a Providential event, the geographical conditions of the Old World were changed, and the route to India, instead of traversing the heart of Egypt, was carried back to the boundaries, and being open to all the world, was no more in danger of becoming the privileged possessions of any.

The foresight of the sentiments expressed in this letter can hardly be questioned. It is in keeping with what was more fully detailed in the earliest publications by Lesseps in France and England and in his whole correspondence with the representatives of foreign powers, to be found in the "Lettres, Journals, et Documents." The present status of English relations to Egypt, largely the result of the construction of the canal, seems to throw light upon the positions taken by Palmerston and Clarendon as foreseeing the possibilities which are now realized.

In an editorial of the London Times as late as the year 1881 it is said:

The opposition to the Suez Canal offered by the Government of this country under the energetic direction of Lord Palmerston is frequently misunderstood at home, and it is, perhaps, not very wonderful that M. de Lesseps fails to do it justice. In point of fact, it was not only reasonable but perfectly successful. The original concessions were accompanied by a rescript setting forth that they required the ratification of the Sultan, and that the works could not be begun without his consent. That consent the Sultan declared he would not give, and Lord Palmerston exerted all his influence to prevent him from giving, until certain large modifications were made. These were not finally settled until 1866, when a convention was drawn up embodying the changes upon which this country had insisted, and the Sultan for the first time issued a firman granting the authority necessary to legalize the company's position. The provision chiefly objected to was that giving the company possession of all the lands which might be irrigated by its sweet-water canal. That privilege was bought back for 30,000,000 of francs, the award being based on the argument that, although the company had acted without authority, yet the viceroy, having encouraged such action, could not plead its illegality as against a claim for compensation. The amount to be paid was, of course, the affair of the viceroy and the company. The point insisted on by England and Turkey was that the possession by the company of lands of indefinite extent conflicted with the interest of the former in the freedom of the road to India, and with the sovereign rights of the latter. Other privileges rashly granted to the company were at the same time bought back for large sums. The right to the forced labor of Egyptian peasants was extinguished at a cost of 38,000,000 francs, while 16,000,000 francs were paid for the rights of the company upon the sweet-water canal, 10,000,000 francs for the repurchase of the Ouady estate, and 30,000,000 francs for the right of posts, telegraphs, fisheries, and other minor matters. The unfortunate Egyptian people have thus paid for the ransom of rights which ought never to have been conceded, a sum of 124,000,000 francs, to which must be added 88,000,000 francs sunk in canal shares, making a total of no less than £8,480,000 sterling. The larger part of this sum represents the arbitration value of the changes which the English Government had insisted upon for reasons of state not measurable in money. The treatment to which our officers have been recently subjected on the canal may enable us to judge of what would have happened had M. de Lesseps still been in possession of his original powers, and may help us to a truer estimate than is sometimes made of the policy of Lord Palmerston.

[Was not England the cause, for her own interests, of the large sums paid out by Egypt?]

SUCCESS OF THE SUBSCRIPTION.

The shippers, merchants, and the public generally in England had concurred in an expression of the great importance of the enterprise which had enlisted the attention of the Institution of Civil Engineers, the Royal Geographical Society, and the large commercial companies,

such as the Peninsular and Oriental and others. But so strong and persistent had been the opposition in Parliament, and so potent the influence of the London Times, although at first seemingly favorable, and that of even the puerile articles of the Edinburg Review against the canal, culminating in the assertion "*that it would neither shorten the passage to India nor materially facilitate the intercourse between the mother country and its dependencies*," that no stock was subscribed in the United Kingdom.

This fact itself, however, largely assisted the subscriptions in France, where it was well understood that the Emperor, the Empress (a kinswoman of Lesseps), and the leading statesmen, including M. Thiers, Guizot, Walewski, and Thouvenel, heartily favored the work.

An analysis of the list of subscribers to the loan shows the following: In Paris 7,377 subscribers, taking 90,121 shares; in the departments and Algiers 13,852 subscribers, taking 116,900 shares; the total of these being half the capital. The Viceroy of Egypt took 177,642 shares. More than one thousand individuals invested in one share each. Of the classes of investors in Paris the professions were represented by more than two thousand stockholders, the bankers and merchants by more than six thousand, the military by nearly one thousand shares.

The closing of the subscription, November 30, 1858, prompted an official notice from the council of administration that the enterprise was now assured; the work would be begun even without the Sultan's firman.

CHAPTER II.

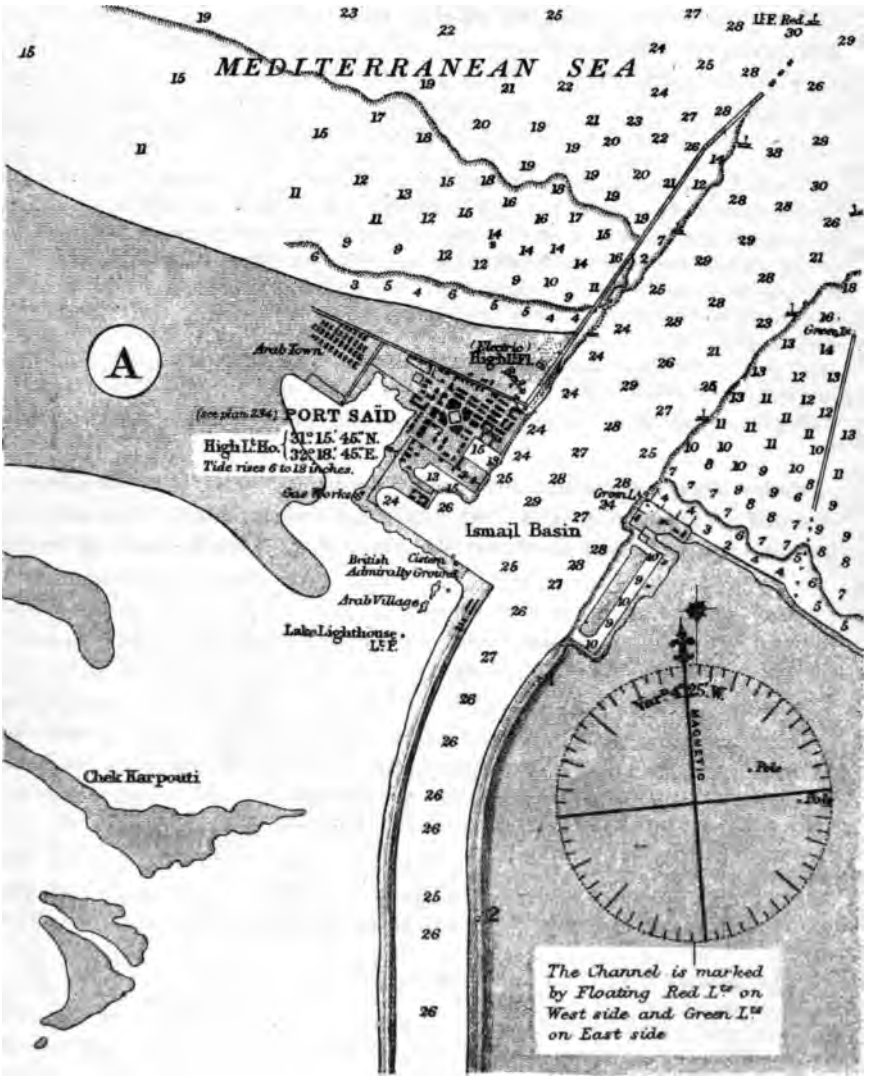
Selection of a site for a port on the Mediterranean.—The site "a harbor against nature."—The work begun on the shore, 1859.—The blocks for the breakwater.—Reclamation of land.—Dredging in Lake Menzaleh.—Supply of water.—The plateau El-Guizr.—Filling of Lake Timsah.—Work from Ismailia to Suez.—The Bitter Lakes.—The Mediterranean admitted 1869.—Seuil of Chalouf.—Work at Suez.—Subsequent traffic.—The appliances used in the construction of the canal at the different periods.—Hand labor.—Withdrawal of the fellahs.—Hawkshaw's report.—Machinery described.—Inauguration ceremonies.—The Fresh-water Canal.

THE NEW PORT ON THE MEDITERRANEAN.

When a position for the embouchure of the proposed canal was to be selected, it was difficult to find a spot along the shores of the Bay of Peluze which could show any natural advantages useful in the construction of a harbor. On the Red Sea Suez was known to be a safe roadstead. On the Egyptian coast the country, as is well known, is remarkably flat. Near the site of old Peluze large lagoons are seen as we approach the land, and behind these a narrow strip of land scarcely rising above the sea level or indicating where the lakes end and the sea begins. It has been remarked by the English captain, Clerk, that "when one observes the scale on which Port Said now exists, no other portions of the vast engineering works along the line of the canal appear more strongly to exemplify the talent and indomitable zeal that have succeeded in so effectual a manner in surmounting the natural obstacles which here presented themselves." The present position of the port was the result of the finding that at a distance of 2,230 yards off shore 30 feet of water was to be secured; a much less distance out than that with a like depth off Peluze, near which the Egyptian engineers had at first thought to locate the port.

It is worthy of note that for this cause, in the course of events, the restoration of the site of the once famous city, "the key of Egypt and of Palestine," the scene of so many battles and of so much historic note in both sacred and profane writings, was destined to be passed by.*

* Pelusium (*pelos*, mud) was anciently a strong city; according to Strabo its circumference was 3,700 meters, or 2⅓ miles. It occupied a site near the present Arab village Tineh—the Sin of Scripture; by Ezekiel, and by the Roman writers it was called the key and the strength of Egypt; the gate of entrance from Palestine and the neighboring countries. The army of Sennacherib met here its fearful loss of the 185,000 slain in one night by the death angel; Cambyses defeated the Egyptians near it, and


MEDITERRANEAN SEA
A
Arab Town
(see plan 234) PORT SAÏD
High Lt. Ho.
31° 15' 45" N.
32° 18' 45" E.
Tide rises 6 to 18 inches.
Gas Works
Ismail Basin
British Admiralty Ground
Arab Village
Lake Lighthouse
Lt. P.
Chek Harpouti
Var. 5° 25' W.
MAGNETIC
The Channel is marked by Floating Red Lts on West side and Green Lts on East side

S. EX. 198., 1, 48.

At the site selected the work was forbidding in the extreme; the strip of land was scarcely 500 feet in width, and over its elevation of 4 or 5 feet only, the sea often rolled under the north wind, while the Pelusiac branch of the Nile from the land side strove for a passage across it to the sea. As a further test of the site, an Egyptian corvette was anchored during the winter off shore, and reported that the holding ground was good; the currents generally feeble; the entrance easy and safe; and that at the bottom of the bay was a plateau of regular slope on which at the depth of 9 meters was a grayish-black mud. The International Commission named had reported more fully that—

The Bay of Peluze, extending from Damietta west to Cape Cassius (now "Straki"), on the east, and facing north 30 degrees east, presents an opening of 55 miles with a breadth of 10 miles. The beach along the whole coast is a formation of fine gray sand, forming a narrow cordon of about 100 to 150 meters in width and 1½ meters deep before the sea level. Behind this cordon was a chain of sand-hills, on which some little vegetation had fixed itself; central around from Peluze was a muddy bottom drained from Lake Menzaleh, and to the west the lake extended 10 or 12 leagues toward Damietta. Through openings which were once small mouths of the Nile the Nile-floods at times discharged themselves into the sea. The shore line of the gulf has not materially varied its form or position during historic times, and therefore may be considered stable.

It will appear further on, that the coast line has made steady advance, as watched and reported by the engineers of the canal and by the officers of the English Admiralty. No serious result has, however, seemed to threaten the canal.

Pompey was here assassinated. To-day ruins of a little fort, the débris of broken columns, &c., are visible. M. St. Hilaire, who accompanied Lesseps when on his crossing the Isthmus in 1856, describes the visit to Peluze: "At 9 o'clock our dromedaries, which seemed equally to long for repose, ascended the last of the low downs which lay before us. From their summit, which was not above 30 feet high, we saw at our feet a wide and black-looking plain, bordered by a line of sand, at a distance of about a league. This belt separated it from the Mediterranean. The plain was that of Pelusium. Knowing how unsafe it is reputed to be, we descended to it with some hesitation. Three of our party, M. Ferd. de Lesseps, his son, and myself, were bold enough to make the experiment at the risk, as was believed, of sinking with our beasts in the mud. The rest of the caravan remained on the downs, anxiously watching our attempt, which appeared perilous, but if successful would shorten our route some leagues.

"All doubt was soon ended, and when our companions saw us advancing securely over this supposed marsh they all followed our example, and in less than half an hour we reached the ruins of the ancient Pelusium. The blackish soil we traversed was the mud of the Nile, which we knew well from having seen it so long in the valley of Egypt, and again in the Wady Toumilat. The rise of the waters this year had been less than usual, and had dried up quickly, and at the end of December we crossed these seas of mud dry-footed and without our camels sinking into it at all.

"The ruins of Pelusium are still very extensive. They commence on the side we approached them with a ruined fort of Roman construction, and, of course, placed upon an eminence. At a short distance I saw the remains of a wide and solid brick wall, like that of a fortress, and on the ground appeared the well-defined vestiges of a large, square inclosure. This was doubtless the site of the citadel."

As late as the year 1874, the engineer, M. le Masson, wrote to the English officer, Colonel Stokes, who was sent out to examine the work for the Admiralty:

> Port Said is a port against nature; its existence is altogether artificial * * *. If the pier were suppressed, the channel would be filled up in a few days or hours. Port Said can only be maintained by its protection of the pier.

The entrance is now kept open by a powerful sea-going dredger.

THE FIRST COMPLETE EXPLORATION OF THE ISTHMUS

March 21, 1859, a caravan conducted by M. de Lesseps, Mougel Bey, and M. Hardon, the first contractor of the work, crossed the center of the Isthmus from Suez to the sea near Peluze, making reconnoissances also of the line of the "Wady Toumilat," the old land of Goshen, for the location of the Fresh-water Canal, a necessity as then foreseen for the supply of water for the workmen in the desert. The notes of this journey, for which space cannot be here given, are of intense interest, as found without remark by the narrator in his Lettres, Journal, et Documents du Canal de Suez, vol. 1. The dangers then experienced by the explorers of the coast which has been now spoken of, were sufficient to deter, one would suppose, almost all projectors from their plans. The caravan found good water at the depths of from 3 to 5 meters on the line, and Lesseps was especially strengthened in his belief that the old fertility of Goshen would be restored by the side canal projected. This has been secured by the results of the work and by the planting of shrubbery along the banks.

THE FIRST BLOW STRUCK.

August 25, 1859, in the presence of about one hundred and fifty persons, at the point selected for the beginnings of the port, Lesseps struck the first blow upon the soil, saying:

> In the name of the Universal Company of the Suez Canal and in virtue of the decisions of the council of its administration, we strike the first blow which shall open the East to the commerce and civilization of the West. * * *

Ten years later, August 25, 1869, the pasha struck the blow which admitted the water of the Red Sea into the channel then completed to the Mediterranean.

The first necessity was to establish a point of beginning which should be habitable and accessible; to prepare dwellings, factories, forges, a light-house, and all accessories indispensable for the mechanical appliances intended to be used. The strip of sand on which the engineers stood was little more than 500 feet wide, and the sea often washed over it.

Their plan was simply to run out a light framing of piles for a crane and for trucks laden with loose stones which were built into a substantial pier, as a landing stage for the receipt of supplies. At a distance of a kilometer and a half, large piles were then screwed into the sands

and settled firmly into their places, and an oblong island was thus formed with stones, the space between "the island" and the wooden shore pier being gradually filled in. This temporary work was carried out about 1,300 feet; at the later date only of 1866 this breakwater was joined to the pier.

At such a desolate point it was necessary to create the possibility of provisioning those who should begin the labor of construction, and for this, access to the first works could be hoped for only from the sea. A wharf was at once begun. Eaten by the worms, this soon gave place to iron pillars screwed into the sand to the depth of 3 or 4 meters, on which was built the islet which has been named, and despite the severity of the winter season a wharfage was secured for receiving the first supplies. The strong piles were secured by Saint Andrew crosses, increasing the cost of the islet of 1,299 square meters surface to 176,500 francs.

THE PIERS.

In the year 1870 two officers of the British Government reported that "the western breakwater, then extending 6,940 feet at right angles to the shore and slightly curved to the eastward towards its extremity, was commenced in 1860, and finished to the length named in 1868; and that from the main-land to the island this breakwater is formed on its inner side of a bank of rubble stones, surmounted by a promenade, over which the spray breaks with a very moderate northwest wind, and on the outer or sea front of concrete blocks; but beyond the island to its termination it is entirely constructed of large blocks of artificial stone, composed of one part of French hydraulic lime with two parts of sand, some of which were transferred to it from the eastern breakwater. This latter, which is also constructed of large masses of concrete, is of more recent construction; it extends about 6,020 feet, and converges towards the western breakwater." The extension and improvement of these piers at later periods will be noted in the last chapter of this paper.

The creation of the blocks to form these was one of the first points of difficulty. What material could be found? Vice-Admiral Paris, in his official notice of the canal, says:

In 1863 M. Pascal presented two plans of the jetties, one to transport stone from Gebel Genéffé (near Suez) by means of a submerged chain 165 kilometers in length; the other, to make the blocks such as Poirel was the first to use at Algiers and afterwards at Livourne. The first plan would have been practicable only on the completion of the canal. On the 20th of October, 1863, a contract was made with M. M. Dussaud Brothers, who had built the works at Cherbourg, Marseilles, and Algiers, for two jetties, one of 3,000, the other of 2,000 meters, by blocks of 3 meters 40 c. × 2 m. × 1 m. 50 c. = 10 cubic meters or 13 cubic yards, and weighing each 20,000 kilograms (or 20 tons).

They were made of sand and of 325 kilograms of lime from Theil, in France, to the metre. The lime cost 65 francs per thousand kilograms delivered at Port Said; the blocks cost about 40 francs per

cubic metre. Nearly 30,000 of them were used. Their manufacture was reported to the United States Coast Survey by Prof. George Davidson, who visited the works in 1875, as follows:

The sand and cement are incorporated in a series of large iron *arastras*, each with four iron wheels for thoroughly mixing the material. Power is transmitted by shafting from steam-engines under a large shed. When the sand and cement are sufficiently incorporated, two closed rectangular openings in the bottom of each arastra are opened, and the contents are dropped into a wooden box about 4 feet square by 2 feet deep, placed on a truck, which is moved about 20 or 30 feet to a position where its contents are deposited in the mold. The blocks, when a little worn, show lines separating the layers, and these appear about 10 inches thick. The béton blocks contain each 353 cubic feet and weigh 20 tons. They are little more than 10 by 6½ feet in length and breadth and 5 feet thick. The material "sets" at once, and then the blocks are parked ready for use. When they are needed, a large iron bridge on two sets of rails is run over the block, which is hoisted in slings by hydraulic power on the bridge, and then moved to another rail at right angles, on which runs a heavy truck. When this truck is loaded it is moved to the shipping point, where similar hydraulic power on a second iron bridge lifts it and deposits it on the vessel. At first, these blocks were made out of beach sand, &c., but they were found to disintegrate badly, and now the company obtains the sand from Kantara, because it contains so great a percentage of silica and no salt. The sand excavated from the canal at Kantara had become hardened in the spoil-banks by simple exposure.

The difficulties in the way of constructing these blocks which presented themselves to the contractors in 1863 are compared by Vice-Admiral Paris with those of the jetty of Cherbourg. The latter, begun in 1784, were incomplete until 1853. Dussaud Brothers contracted to furnish for Port Said 250,000 cubic meters in the years 1866–'68 on a shore offering no access except at the outset from the islet and wharfage on the sea. [The title of the little work referred to is, *Notice du plan en relief au canal maritime de Suez, exposé dans la Salle de Lesseps Musée de Marine au Louvre par Le Vice Amiral Paris, conservateur du Mesée.* The work comprehends a great deal in small space. A new edition, improved upon the one consulted while the author was in Paris, is welcomed. The political and other retarding causes delaying the modern finish of the harbor of Cherbourg would seem, however, at the moment lost sight of by Admiral Paris.]

Three hundred cubic meters of concrete were made per day, ready for immersion after hardening. The machinery for mixing the concrete was of 70 horse-power, the mixture being tested by selecting sections and placing them under a pressure of 80 kilograms (170 pounds) to the square centimeter—fifteen one-hundredths of an inch. The proportions found at a later date to be preferable were: Portland cement, 1; sand, 2; gravel, 5. As confirming the character of this work it may be here said that, at an examination by the French engineers ten years later, the condition of the submerged blocks showed that they had been protected from disintegrating influences by a covering of shells and weed; but the upper blocks, exposed to the action of the air and spray, had suffered. Of 1,459 blocks that were then visible 1,059 were broken, most of them showing traces of chemical disintegration.

For the reception of supplies and maintenance of the laborers a light-house on the coast was to be immediately built, and on the narrow cordon temporary huts for the fellahs. The first light-house, 20 meters high, was visible at a distance of 25 miles. At first the workmen lived on floors but 2 meters above the pools and at times submerged; their supplies of food and fuel, clothing and tools were all brought over from Europe; their drinking water was carried in barges all across Lake Menzaleh from the main-land after being transported from the Nile on camels and donkeys, of which some three thousand were employed. These the officials as well as the natives often stopped on their way. On some occasions the supply failed. When the news reached our projector, who was at Alexandria, he at once freighted a steamer with sets of distilling apparatus and a staff of workmen, and for the future made his parties independent of native supplies. The laborers are reported to have fought sometimes for their drinking water.

At the expiration of the second year a small dredging machine was received by its having been transported in sections across the sands and the mire of the lake, the transportation of its boiler having required the use of twenty camels. The dredgers excavated a narrow opening for access from the sea and then further excavations were made on the sides for the banks. The dredgings quickly hardened. The aggregate of the excavations made for the completed port and its dependencies exceeded the number of 4,600,000 cubic meters, nearly 6,000,000 cubic yards.

WORK ON LAKE MENZALEH.

The large lake is separated from the sea by a tongue of land from 500 to 600 feet in width, through which some occasional and a few permanent channels exist. In ancient times this was the most fertile province of Egypt; at present three branches of the Nile bring some fertility within a spot of which the pelicans are almost the only inhabitants.

Beneath the waters are seen the ruins of large cities with their baths, tombs, and masses of pottery and bricks. Southwest was the city of Touna, and on the west "Zoan," and at a later day Mansoorah, where Saint Louis was made prisoner in the crusade of 1251; on the east also is Tineh, the "Sin" of the Bible, the Pelusium of the ancients, so populous in the times of Alexander. Below the lake, still in sight, may still be seen the base of a large temple, columns of red granite, and hillocks of brick; no more of the former grandeur; mud and slime only.

The lake to day is a large marsh of salt water resting on clay; in spite of its character it has not proved specially unhealthy. The line of the canal here for 44 kilometers presented difficulties in place of less work, for its varying depth presented obstacles in the way of any connected work; but the vigorons race of fishermen on its borders, accustomed to the sun and the mud, scooped up the clay in their hands, rolled it into

balls on their chests, and then carried it off on their backs with their arms crossed behind. In this way they raised about 400,000 meters, until the first dredge, let down into the mud by sections, carried forward the work followed by twenty others, and finally by the noted *long couloirs*, to be described further on. The first *rigoles*, small side cuts, here as in other places, were the limits on each side of the present line of work bounding this large lake on the east.

DREDGING THROUGH THE LAKE.

To effect a channel through the 27 miles from Port Said to Kantara, was a work of greater difficulty than that executed at the port. The sulphuric exhalations of the mud, when stirred under the burning sun of Egypt, were almost insupportable; yet not much more sickness was reported to have occurred than in other localities. The lake fishermen threw up the liquid mud with their hands to form a dike, which, under the powerful sun, quickly dried. When something like an opening had been made and water began to flow in, rafts were constructed on which thousands of these men slept under tents made of mats. An excavation of 400,000 meters was effected.

When the men had scooped out with their hands a passage of sufficient dimensions dredging machines were introduced and the trench was widened until it reached the dimensions of 330 feet wide and 20 feet deep. The banks on both sides were solid and firm. On these the dredgers with long shoots were subsequently used, which dispensed with the expensive mode of disposing of the débris into hopper barges and then conveying them to sea to be emptied. The first little dredger (carried in sections across the mud) was followed by twenty more, which excavated two ditches 20 or 25 meters in width, leaving the intermediate space to be excavated by the dredgers with long shoots.

EXCAVATION ON THE LINE OF THE DESERT—FORCE EMPLOYED AT DIFFERENT PERIODS OF THE WORK.

The natural and necessary outlook at the first was towards manual labor, both in the land-rigoles, and has just been shown, in the shallow lakes, and this seems to have been the chief expectancy. Within the concession of 1856 a decree as to native workmen provided that they should be supplied by the Egyptian Government at the demand of the chief engineers. At one period in the construction of the canal more than 25,000 were employed.

This decree also provided that the wages allowed should be fixed according to the average of wages paid for work by private individuals, at the sum of from 2½ piasters to 3 piasters daily, exclusive of rations to be given in kind by the company, at the value of 1 piaster. An ordinary fellah made from 6 to 8 piasters (1½ to 2 francs) per day. Skilled workmen, such as masons, &c., received the wages allowed for

Government works, besides rations; and when soldiers of the regular army were employed, their extra pay equaled the pay of the civilians. The company was bound to shelter the workmen and provide at its own cost a hospital and ambulances. The engineers, Linant and Mougel Bey, had the head supervision of the workmen.

The supply of daily necessities, especially of water, became a yet more serious problem. It was procured often at great expense, and from such distances that it was found more economical to furnish it from distilling apparatus. The workmen lived mostly on rice, sorgho, dates, and onions. Contrary to the alleged impracticability of the work through this lake, "that the bottom would not hold water, the shifting mud or sand sucking it all up," the banks, when finished, stood about 6 feet above the water, and the sun baked them into so solid a mass that they were used like roads for the transporting of heavy loads.

THE PLATEAU OF EL GUISR.

The canal having now reached the main-land, a few miles further brought the line to Lake Ballah, an irregular swamp through which and to a little distance beyond, the cutting was carried for about 12 miles. The lake was nearly dry, and the excavated gypsum failed to form solid banks; other material was brought from some distance. The crystallyzed gypsum, treated in lime-kilns, proved of great service for the constructions at Port Said.

Lake Ballah terminates near El Ferdane, where the desert commences. This land is determined by a ridge of sand about 3 feet above water; a slight depression follows, the undulations becoming more marked, and extending along a distance of 6 miles. Then a sudden rise occurs in face of a mound 65 feet high and 650 feet in length, after which comes the last depression, a sort of valley descending 13 feet, and the Seuil d'El Guisr presents a veritable rampart 67 feet high. The maritime canal must pass through this cutting, to allow the waters of the Mediterranean to flow into the future interior basin of the canal, Lake Timsah.

A trench was first cut, enabling a supply of provisions to be brought from Port Said. Twenty thousand men were engaged in digging the Seuil d'El Guisr; two thousand camels, each carrying two water-casks of 25 gallons, brought the water supply from a distance of 20 miles until the Fresh-water Canal was finished. From the summit of El Guisr to Lake Timsah the plateau undulates for about 4 miles, terminating abruptly like a cliff on the edge of what was found a shadowless, dreary desert.

THE FILLING OF LAKE TIMSAH.

The filling required 80,000,000 cubic meters of water. When it was filled, and the dredgers floating at El Guisr were producing important results, the question was again how to get rid of the stuff. Barges were

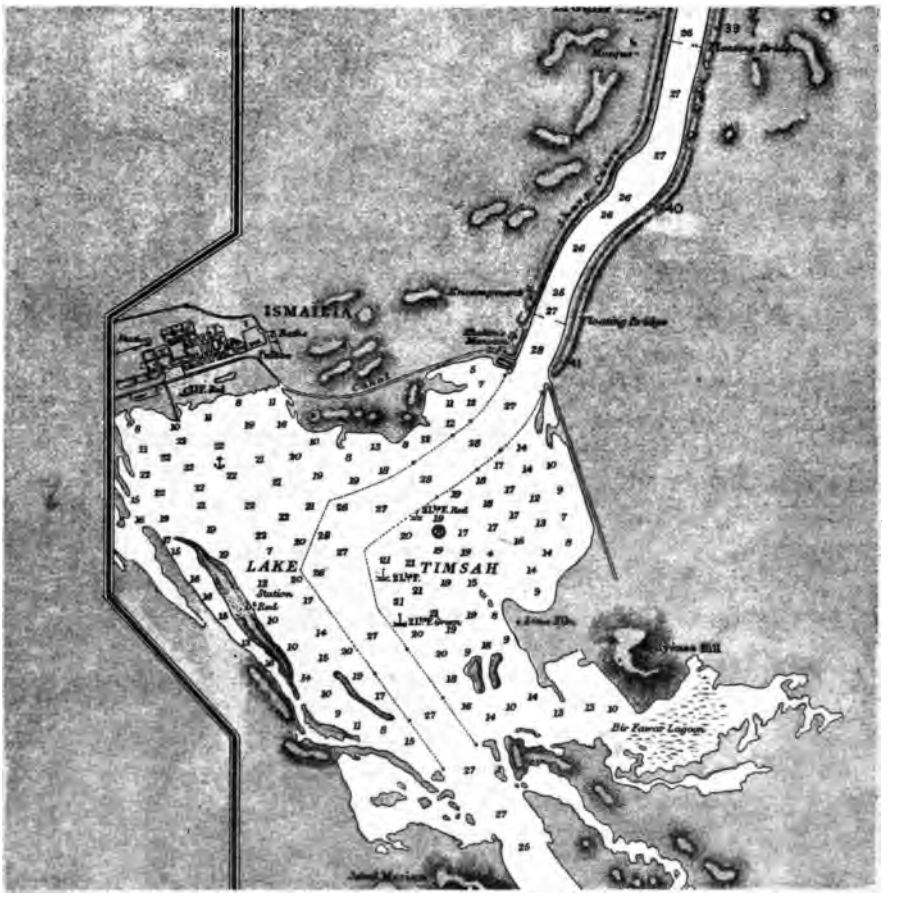
constructed, each capable of conveying 90 to 120 cubic meters, which were discharged on the borders of the lake.

As soon as the short line of the Fresh-Water canal was completed to the lake, a water-tower was erected and a steam engine set up at El Guisr, capable of pumping up 1,500 cubic meters daily. Pipes were then laid down along the banks with hydrants at every kilometer and water was conveyed to Port Said, supplying the wants of twenty thousand people. This was effected by the close of the year 1860. Two years later a water way sufficient for flat bottom boats of small draught, opened the first direct communication between the lake and the Mediterranean. On the 4th of March, 1863, the new town which had risen on the northern side of Lake Timsah was formally named Ismailia, in honor of the new viceroy, Ismail, Said Pasha having died the year previous.

FROM ISMAILIA TO SUEZ.

From this half-way point on the line its lower section was executed with much difficulty. It comprised a cutting through the plateaus of Toussoum and Serapeum; then a passage of 24 miles through the bitter lakes, a cutting through the Chalouf Height, from which was a level sweep of 12 miles to Suez. The cutting in the Serapeum plateau offered the greatest difficulties. Manual labor first failed here. But the skill of the contractor brought into use the Fresh-Water canal, which had been made to progress always in advance of the excavation of the main channel. Three millions of cubic meters were required to be excavated. The natural level of this canal from the Nile being found the same with the highest parts of the undulating hill of Serapeum, M. Lavelley made a cutting through the intervening space, with the object of inundating these heights, and in that way introduced water and floated the dredges, which were ready in the Fresh-Water Canal to come in. This contrivance did away with the necessity of a large contingent of men, and greatly expedited the work. It was at first supposed that the water would not have sufficient hold on the loose sand of the dunes, and that imbibition and evaporation wouldbe too great for its retention; it was not without misgiving that the experiment was made. But as the sand contained fine particles of calcareous matter, its admixture with the muddy deposits of the Nile rendered the earth sufficiently impervious to retain the water. The hollows filled with water from the Nile were kept isolated from the other portions of the canal until the dredgers had effected a cutting from these heights, 26 feet deep. The dams were then removed and the water allowed to run off into the Mediterranean and the Red Seas, until the sea level had been obtained. Meanwhile the dredgers gradually sank with the receding waters, and floated on a level with the two seas.

Dredging was continued until the required depth of 26 feet below the sea level was reached, the dredgings being emptied by hopper barges into Lake Timsah.



S. EX. 198, 1, 48.

THE BITTER LAKES.

The depression here was found divided into two plains; the first, descending from the heights of Serapeum is 30 feet below the sea level and 16 miles in length; the second, 20 feet below the sea level, 9 miles in length. The surface soundings showed sand and sulphate of lime, with clay more or less mixed with quartz, a thick coating of salt being found in the larger lake. In both, isolated water-lines of high and low tides were found with sediments of gravel and a horizontal bank of agglomerated fossil shells. The lakes were nearly dry. The work upon these lakes separated them from the Mediterranean until the necessary arrangements were completed for the gradual admission of water at the late date of 1869. A part of the water to fill them was drawn between the 1st of March and the 1st of October of that year from the Mediterranean; the larger portion between the 1st of July and the 1st of October from the Red Sea. The rate of admission through the sluices was 40 meters per second at the commencement and 70 per second toward the close. April 18, 1869, in the presence of the khedive, the lakes were united to the Mediterranean. During a visit to the canal made about the same time by the Prince and Princess of Wales 4,000,000 of cubic meters of water were admitted within twelve hours. The complete filling (October 24) required 1,500,000,000 cubic meters.

THE SEUIL OF CHALOUF.

At the point where the depression of the Bitter Lakes ceases, the land begins gradually to rise until it attains a height of 16 feet above water level, and forms the third elevation, called the Seuil of Chalouf, where very hard bank of rock was found of 15 to 23 inches in thickness at the southern portion, and from 6 to 9 feet below the level of the Red Sea. The other part of this rock was sunk 13 to 16 feet below the same level. The Seuil of Chalouf is about 4 miles long, and then, from Chalouf to Suez, the maritime canal flows through a large plain of nearly 10 miles in length. This was the most difficult cutting, aggravated by the presence of this rock, which had to be blasted. It was not possible to apply the principle successful at Serapeum, on account of the length of the land which it would be necessary to submerge to allow the dredging machines to float. The excavation of this part was by hand labor. Barrows along inclined planes deposited the soil in wagons drawn up by chains fixed to a steam-engine. Pumps were placed at certain distances to carry off the water from infiltration at the bottom of the cutting into a trench to the Bitter Lakes.

In 1869 only, the difficulties of the desert between Chalouf and Suez were finally overcome, 75,921,270 cubic meters of the whole line of the canal having been excavated, and on the 25th of August of that year the artificial barrier which separated the Red Sea from the Bitter Lakes was filled with water from the Mediterranean.

The clay which formed the base of Chalouf was found to be full of stones, forbidding the use of dredgers. In two places it was necessary to blast a bank of very hard rock between 2 and 3 feet in thickness to the amount of 35,000 cubic meters. In this case the surface was first cut down by the employment of hand labor and the barrow, and then cars were run up inclined planes by locomotives with the endless chain. Ten million of cubic meters were taken out of the trench to the depth of 19 meters. Among the excavations were found enormous fossil remains of the elephant and of the dog-fish, mixed with layers of bicarbonate of magnesia. The whole depth of 27 meters from the height of the bank was excavated by hand. About six thousand laborers, of whom fifteen hundred were from Piedmont, worked at the mines and the wheelbarrow.

Between Chalouf and Suez was found another bank of rock, which was avoided by deflecting the line of the work to the east. The calcareous strata of this short section was also excavated by hand labor to the amount of more than 7,000,000 cubic meters. Six thousand laborers with the barrow were employed and 2,000 were at work on twenty-nine inclined planes. This work was supposed to be finished as late as August, 1869, but in November following, fifteen days only before the canal opened, newly discovered rock was blasted.

SUEZ.

By a report made by Captain Clerk, R. N, in 1869, the principal operations of the canal company here had been, up to that date, the construction of a mole 850 yards in length, at the mouth of the canal, to serve as a protection against southerly gales, and against the action of the tide at high water; secondly, the dredging to the requisite depth the channel leading from the canal to the anchorage in the roads of Suez, and the reclamation of land. The mole from the Asiatic shore, constructed of calcareous rock quarried on the western shore of the bay, was then nearly completed. No rock had been found to interfere with the dredgings which were employed to make the embankments. These, faced with stone, were made to receive the dredgings thrown behind them by the *dragues à long couloir* and this process, continued to a considerable elevation above the sea level, was daily reclaiming a large section of land for the requirements of shipping.

On the southwest side of the harbor a dry-dock had been constructed by the Messageries Impériales Cie, under a contract with the Egyptian Government; its length was 415 feet, its width 85, and its depth of 29 feet. A double basin had been made with sufficient depth of water for vessels to lie alongside. Of two piers, the one reserved by the Egyptian Government was connected by a railway along a jetty three-quarters of a mile, with the terminal station of the railroad from Cairo.

The village of Suez was the *entrepôt* of oriental commerce in the times of Sesostris, of the Romans, and of the Caliphs. East of it, at the end

Railway to Cairo
Railway to Ismailia
Fresh Water Canal
Water Works
Arab Huts
Mohammedan Cemetery
Marabout
SUEZ
Telegraph
Mud Flats
partially dry at L.W.
MARITIME CANAL
P. Ibraham

S. EX. 198, 1, 48.

of the canal of Darius, may be seen the ruins of Arsinoe or Cleopatris. The discovery of the route by the cape was the ruin of Suez; it was a miserable village at the time of the French Expedition and received its first new life, in 1831, on the establishment of Waghorn's overland route. The first water supply afterwards brought by rail from Cairo was costly; the Fresh-water Canal first met the necessities of the people. Previous to the opening of the Maritime Canal, Suez contained but 4,000 inhabitants, and exhibited no signs of activity except when the steamers were embarking or disembarking passengers and merchandise, to or from the East. In 1870, the population had increased to 25,000. In 1856 the International Commission, in their report on the proposed canal, said of this harbor:

The roadstead is capacious and safe; 500 vessels and more can ride. The depth varies from 5 to 13 meters. The English corvette Zenobia stationed here from 1853 to 1856, as a coal-tender for the East India packet, did not shift her anchor; communication from shore was not interrupted for a day. Two deep and safe channels, wide enough to permit vessels tacking in all weathers both entering and clearing out, lead into the anchorage through soundings from 16 to 20 meters.

The bay (says Elbers) opens out a picture of indescribable coloring. The sun sets behind the steep cliffs of Attakah, on whose heights ages ago Phenician sailors, before setting south for Ophir, lighted fires and offered sacrifices to Baal Zephon, the god of the north wind. There can be no spot on earth where the god of day surrounds his death scene with greater splendor. The Red Sea, which at noon has a greenish color, on clear evenings assumes a deep blue, and when a light breeze curls its surface, each crisp wave is touched with golden glory. The mountain looks as if composed of a glowing flux of melted rubies, garnets, and amethysts, mirrored and repeated in the waves that dance and sport at its feet.

In this connection it may be stated that the importance of Suez has been largely increased by the canal traffic, shown on the first pages of Chapter I, and by the establishment of the new lines of steamers passing now through the route in place of touching only, as formerly, at the port. The largest lines availing themselves of the short passage from the date of its opening are the Peninsular and Oriental Steamship Company, the Messageries Impĕriales, and the Ocean Steam Navigation Company of Holt & Co., of Liverpool. The fleet of the latter increased its tonnage through the canal from 20,868 tons in 1870 to 56,746 in 1874; a large increase has recently been made by every steamship company.

The Peninsular and Oriental Steamship Company was chartered in 1840. In 1855 its ships brought the India mail to Suez twice a month only. In the year 1875 its fleet consisted of forty-eight steamers of a tonnage from 1,224 to 3,782 tons, aggregating 120,387. The number of trips made that year through the canal was one hundred and fifty-six, and the tonnage passing both ways through during the last six months of the year was 221,223 tons.

At the opening of the canal, the company's business was carried on entirely by the overland route, and as only goods easily handled and of high value could bear the transshipment and heavy expense the

cargoes consisted almost exclusively of silks, shawls, &c., the more bulky products of the East, tea, coffee, cotton, &c., and the cotton goods exported from Europe, being carried around the Cape. The space required for cargo then was of course very small. But now the whole is changed, the largely-increased space for cargo being filled, both outward and homeward, with the less valuable goods.

The influence of the opening of the canal at the date of 1875 is thus contrasted with the state of things previous, in the points of time and speed: The distance from Alexandria to Suez is 248 miles, and thence to Calcutta 4,757 miles; the average speed of steamers between England and Alexandria and between Suez and Calcutta had been but 9 knots; the transmission of the India mails at one time occupied a month to Alexandria only. In 1875 the time had been reduced to less than thirty-six days from London through to India. In 1881 the time from London to Australia was but thirty days.

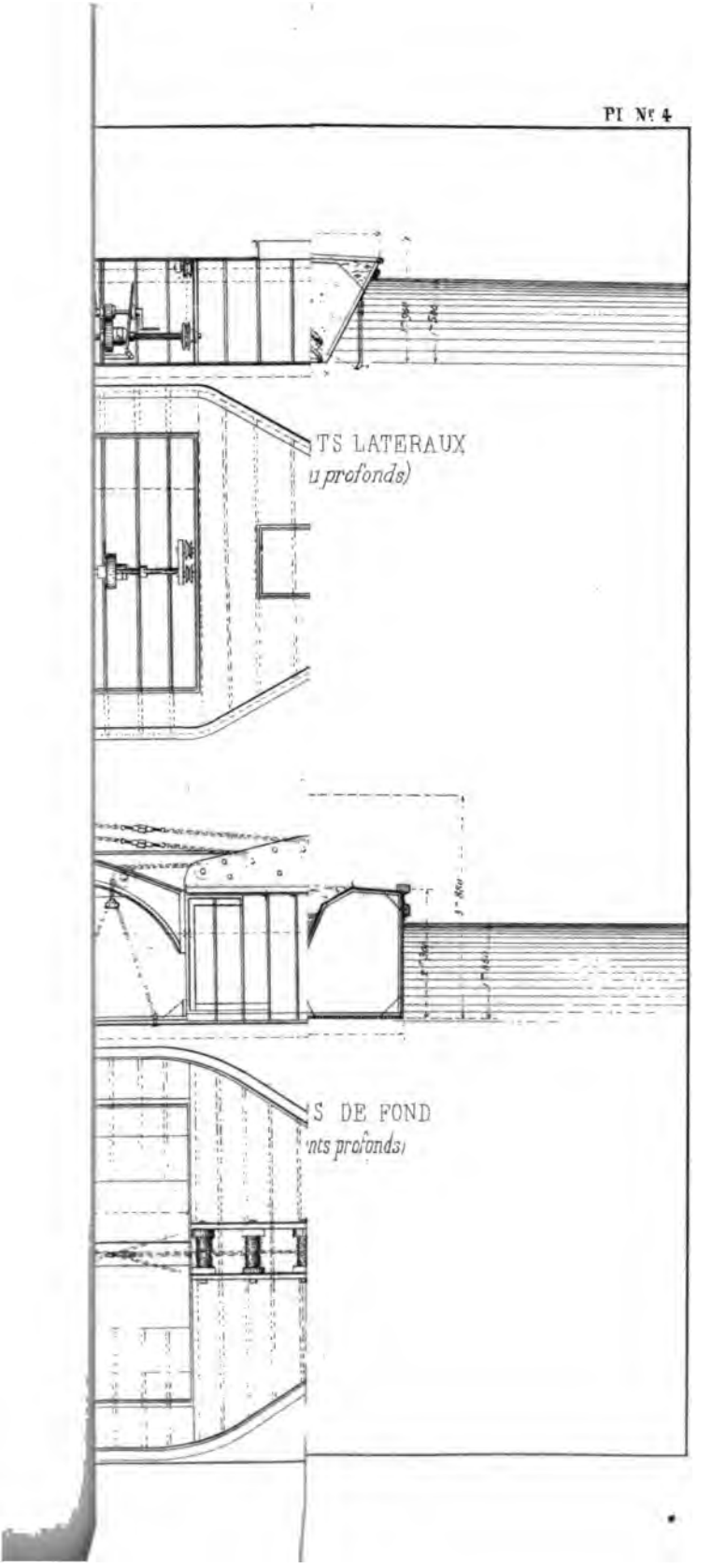
The cost of travel from England to India in 1843 was £140; in 1866, £99; in 1875, £68. Before the canal was opened the Egyptian charge for travel across the Isthmus was £4; the canal charge is but 2010 francs, or $2, in place of the old charge of $20. The three sources of labor and wealth to Suez have been the commerce of the Red Sea, that of India by the mail packets, and the transport of the Pilgrims to Mecca. The overland commerce before the opening of the canal was carried on by camels; in 1849 the number of camel-loads was 70,000, in 1852 91,000; in 1856 120,000; the camels were three entire days on the journey from Suez to Cairo at a cost of 12 francs a camel, each camel carrying a load of from 500 to 600 pounds. Suez is now declining.

DIFFERENT APPLIANCES EMPLOYED.

The means made use of in the construction of the canal merit a fuller descriptive detail. This best shows itself in the progress of the work as reported to the stockholders. At their first annual meeting, May 15, 1860, the following was, in substance, announced:

The first contractor, M. Hardon, had installed his *personnel;* he had at work twenty-four dredgers (*toile sans fin*) on a plan, the invention of Mougel Bey. They were expected to dredge 1,000 cubic meters in a day of ten hours. On the strip of land separating the sea from Lake Menzaleh a temporary wooden wharf had been built out 300 meters, a little distance from which workshops, a saw-mill, coverings for the workmen, and twenty wooden houses for the overseers had been constructed. This was the commencement of a town on the basin dredged 100 meters from the shore. The light-house of the fourth class, which has been described, had also been finished.

At Zahcireh, an isle in Lake Menzaleh, work had been begun; at Kantara ten wooden houses, a well, and a limekiln; at El Ferdane, 18 kilometers further on, another shaft had been sunk, and four houses and a lime-kiln built.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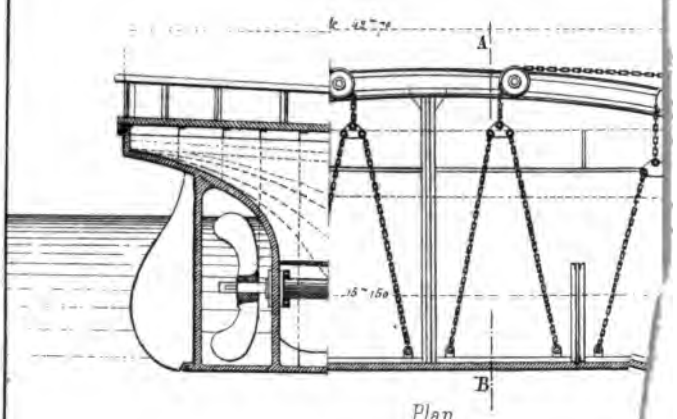
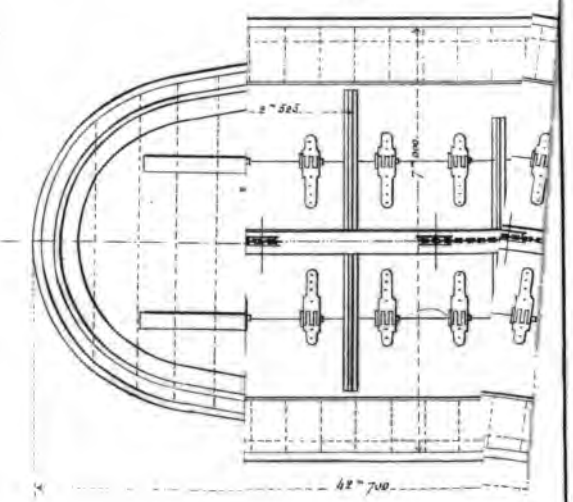


Plan.



S. EX. 198, 1, 48.

Outside of the basin of Lake Timsah, near the traces of the canal to join the Nile, an encampment was begun at a point called Bir-Abou-Ballah, an old place of exchange between Egyptian and Syrian merchants, and where M. de Lesseps thinks Joseph met his father Jacob. Here some ancient wells have been restored.

Eight kilometers further south from this basin, workmen had begun the encampment of Toussoum, and were making the necessary levelings for the conduit of fresh water to be brought from the Nile canals. Thirty-three buildings of various sizes were in construction. Near Serapeum, and between this place and Suez, wells had been sunk, and shafts for the working of the lime quarries of Gehel-Geneffé. At Suez the proper line of the canal was reinvestigated and preparations made for occupying the quarries at the foot of the mountains at Attaka. The whole work thus far had been carried on by hand.

By January, 1861, the Nile waters had been brought to the foot of El Guisr, and at Bir-Abou-Ballah, in the center of the Isthmus, a steam-pump raised the water to the summit level; 1,300 fellahs had been here employed. At Port Said the filling in had raised the base of the new town safely above the highest inundations of Lake Menzaleh when swollen by the Nile overflow. At the second annual meeting, May 15 of this year, Lesseps reported that Port Said had become a city of 2,000 inhabitants and its harbor had receive one hundred and thirty-five ships, with the gross tonnage of 29,000 tons; that the quarries of Mex, opened to a length of 500 meters, had furnished the steady delivery of blocks for the jetties, to which they were carried by large steam cranes on wagons drawn on railways; and that, of the two jetties the one which had reached 275 meters was already a shelter for vessels. Further, that the excavation of El Guisr was about to be commenced, a water *rigole* bringing the Nile water to Timsah, and the machinery for excavation at El Guisr being on the ground. Shelter for 10,000 workmen had been built, and 3,000 were at work on the Fresh-water Canal.

In January, 1862, the water service *rigole* was fully opened between Port Said and Ferdane; its depth was 1.20 meters, its width 8 meters (between Kantara and Ferdane 12 meters); the length of this navigable route was 70 kilometers.

The Fresh-water Canal had been nearly finished to Ismailia. Its length was 134,835 meters, its width 12.50 meters at the water-line, with 1.20 meters depth. The excavation for this had been 1,013,202 meters, employing between six and seven thousand workmen nine months. At Port Said the constructions were carried on with vigor; the population consisting of 1,000 Europeans and 3,000 Arabs. The shipping visiting the port had increased to 40,000 tons. Along the line of the works the buildings erected occupied an area of 37,249 meters. Twenty-four dredgers were in line. The works were ready for 20,000 Egyptians; 40,000 had been named as the *corvée* by the pasha.

August 1, 1862, from the elevation of El Guisr, 2,887,839 meters of the

3,900,000 to be taken out had been extracted; November 18, a telegram from Timsah announced the completion of this work, on which 25,000 men had been for some time employed. On that day, the entry of the waters of the sea into the lake was celebrated by an ovation at which the consul, of France, Italy, Holland, and Austria, the "Scheik-Ul-Islam," and the Catholic bishop of Egypt were present.

At the close of the year 1862 vessels from the Mediterranean entered Lake Timsah by a *rigole* canal of 15 meters width with a depth of from 1.50 to 2 meters. At Port Said the jetties had received 17,000 more cubic meters of blocks, and the iron-work on the sea isle sufficed for a very safe approach. Twenty-four dredgers were at work, each one excavating 10,000 cubic meters a month. On the line 22,000 Egyptians, under 1,500 Europeans, were working in the trenches; 3,500 natives were in the workshops, and 11,000 Bédouins had come to settle themselves in the valley of the Ouady Toumilat, on the company's lands, under temporary grants to cultivate these now irrigated by the Fresh-water Canal. A branch of this was next begun towards Suez. A telegraph line connected the works to Cairo and thence with Europe.

WITHDRAWAL OF THE FELLAHS.

At this point a new era commences in the history of the canal. The opposition of England manifested itself with increased force both at London and at the Porte. To meet measures already threatening serious delay to the works, Said Pasha had invited Mr. John Hawkshaw, then president of the Institution of Civil Engineers, to visit Egypt and thoroughly inspect the work, and, on the part of M. de Lesseps, an invitation was extended to both the friends and enemies of the canal to make the most thorough scrutiny. The latter invitation was accepted by the director of the Messageries Impériales, by the Duke of Brabant, the Emir Abdel Kader, United States Consul W. S. Thayer, and by the new English minister at Constantinople, Sir Henry Bulwer. Consul Thayer, after the inspection, wrote to the projector:

> I do not believe, after what I have witnessed, that any impartial person can doubt the practicability of the canal. By your energetic perseverance the imaginary political objections have disappeared and the less formidable natural ones will follow their example. I congratulate you alike on the success of the past and on the scarcely less certain triumphs of the future.

Sir. Henry Bulwer's inspection extended through ten days. He then said that "Silence was permissible in a diplomat; that he should not express all that he thought"; leaving behind him the very plain impression that new points of opposition would be raised by England. These were soon to manifest themselves against the employment of the natives and the cession of the lands of the Fresh-water Canal and of that canal to the company.

The opposition which thus resulted forced almost an entire change

in the appliances and in the force employed. It obliged the company at great loss of time and cost to replace the native force yet, by machinery which finally secured greater efficiency. The history of this change is here cited from our then consul-general, Mr. de Leon:

The ingenuity of the English agents detected a weak spot in the concession which provided that in all cases at least four-fifths of the workmen should be Egyptians; a clause inserted through the jealousy of the Egyptian Government to prevent too large an introduction of European laborers into the country. This labor was to be procured, as all Egyptian labor ever was, and is to this day, both for private and agriculture and public works, by the system of *corvée;* that is, conscription for compulsory labor for a limited period (one month) at a fixed rate of recompense. No sooner, therefore, had the new company, under the active superintendence of M. de Lesseps, collected 20,000 fellahs as laborers, giving them much higher pay than ever was promised by the Egyptian Government—lodging, food, and medical attendance, and half-pay when sick—than a howl went up from England and Exeter Hall, whose echoes reached the East, that the horrors of the slave trade were being revived by the French in Egypt. Lord Stratford, therefore, demanded of the Sultan to stop this scandal, and a peremptory order by him, backed by the voice of England, came to Said Pasha to stop the work at once and dismiss the fellahs. The combination was too strong and the pressure too heavy for Said, bold as he was, to disobey. He summoned to his councils the consuls-general of the other powers and demanded of them if they would sustain him in resisting this order. None would promise him anything more than moral support, and turning to the American he impatiently asked:

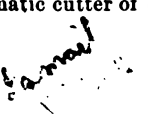
"Your Government is not afraid of the English! Would they support me with ships in case I should resist?" "Certainly not, your highness," was the prompt reply; "Suez and India are very far from America, and her interests there are very small indeed."

"Well, then," responded the viceroy, "poor Lesseps must go to the wall; but it is a great shame. *Mais que voulez vous?* Egypt is a little place, and I am a little monarch.

But the indomitable de Lesseps did not despair, although he saw his encampment of 20,000 laborers broken up and dispersed in a day, leaving only a quantity of tools and tents behind them, as evidence of their having been at work in tracing out his canal. He summoned laborers from Europe, and they came after months of delay; but no sooner had they come in sufficient numbers, been organized, and the work recommenced, than the evil genius of England again interposed; the imbecile Sultan's firman this time denying the right of the viceroy to cede the lands through which the canal was to be dug. A partial stoppage of two years in the work took place.

Lesseps's patience and energy were crowned with success at last. The Emperor, who had long turned a deaf ear to the project, was seemingly stung into enlisting his influence by the insolent expression of England's triumph, through their press, over the failure of what they persisted in calling the "French intrigue in Egypt." The French consul-general, who had enforced the Sultan's order by commanding obedience to it, and who was known to be unfriendly to the enterprise, was recalled from Egypt and instructions given to his successor to favor the project, which was for the first time thus taken under French protection, and the French minister, M. Thouvenel, requested to enlighten the mind of the Sublime Porte as to the views and wishes of France.

"Sultan Stratford" had for once more than met his match, and his authority waned from that hour. At a hint from a high quarter Said Pasha submitted the whole matter in controversy between M. de Lesseps and himself to the French Emperor, and neither Turkey nor England dared to interpose any objection, though both felt themselves checkmated by this adroit move of the diplomatic cutter of canals.



REPORT OF SIR JOHN HAWKSHAW.

The report of Mr. Hawkshaw, referred to as made at the invitation of Said Pasha on his visit to England in 1862, was the result of investigations made on the ground in November and December of that year. Its formal presentation to Ismail may have have been fortunate, as the new prince did not inherit a favorable idea of the work.

Mr. Hawkshaw closely examined the works on land; he verified the soundings of the Red Sea at Suez; inspected the estimates of expenses; compared the report of the International Commission of 1855 with the investigations reported to the English admiralty by the English naval officers, Captain Spratt and others; with the unfavorable opinions of the late Robert Stephenson, and with those of a commission appointed by the King of Holland.

The obstacles which the company were then overcoming were very serious. He says:

> No fresh water can be found anywhere on the line. Even at Suez fresh water is to be had only by bringing it from Cairo. Long lines of iron tanks constantly pass and repass on the railroad between these places. The workmen on the canal line are supplied from cisterns placed at regular intervals and filled from casks brought on camels' backs. The Fresh-water Canal from Ras el Wady to Lake Timsah, and eventually further on to Suez, is, therefore, an evident necessity. The iron pipes are also beginning to be laid from Timsah northward to Port Said. The main work itself is being carried on partly by native laborers and partly by dredging. The largest numbers of laborers whom the Viceroy finds himself able to withdraw from their own occupations to serve their monthly term for this work is a contingent of twenty thousand men. If the company could have had the steady labor of thirty thousand men, their engineer believes that, by these, they can finish the canal in three years. The company own and work twenty-four dredging machines, each raising a thousand cubic meters a day.

Mr. Hawkshaw estimates that about 40,000,000 cubic meters in all were still to be excavated, and, therefore, that a safe estimate for the completion of the canal would be five and a half years.

He considers fully in his report the formidable objections which always had been alleged against the work, which were chiefly these:

1. That the canal will become a mere stagnant ditch.
2. That it will be filled up with mud and with the moving sands of the desert.
3. That the Bitter Lakes, through which the canal would pass, will be filled up with salt.
4. That the navigation of the Red Sea is too dangerous and difficult.
5. That ships will fear to approach Port Said because of the difficulty of that approach and the dangers of the lee shore there.
6. That it will be difficult, if not impossible, to keep the passage from the Mediterranean into the canal open.

He discusses each of these objections impartially, and entirely refuted and removed them. To the first he replies, in substance, that so *far as* the mere want of a current itself is to be considered, admitting

even that there would be none, this canal would in this respect only be like those of England, Holland, and other countries, where we might just as well use the same term, "stagnant ditches," yet they answer all the purposes of navigation. But this Suez Canal, said he, will not be entirely without any current:

The International Commission, who feared that it would not be strong, determined at the close of their investigations that between the Bitter Lakes and the Red Sea the greatest velocity of the tidal-current at the bottom of the canal would be 1 meter 16 centimeters (3¾ feet) per second; ordinarily it would be less.

As to the filling up of the canal by the sand and mud, Mr. Hawkshaw says: "The level of the high equinoctial tides at Suez is 1 meter 12 centimeters above the mean level of the Red Sea; with a strong south wind it may rise to 1 meter 64 centimeters. In the Mediterranean, the high equinoctial tides are but 13 centimeters above the mean level of the sea; with a strong north wind they may reach 50 centimeters above the mean. On account of the great area of the Bitter Lakes, 330,000,000 square meters, compared with that of the canal, their level will be little affected by the tide, but will remain about the same as that of the mean level of the Red Sea, except when under the influence of the north or south winds. The tidal current in the canal, caused by the rise and fall of the Red Sea, will be the most effective agent in keeping this part of the canal open and free. The same thing will be true, though not to the same extent, of the part between Lake Timsah and the Mediterranean. Calculating the evaporation from the surface of the canal to be about one centimeter a day, and the infiltration to be half as much, the quantity of solid matter deposited in the whole line of the canal would be but 22,500 cubic meters annually, or less than one-quarter of a centimeter in depth, an insignificant quantity, surely.

In regard to the drifting sands of the desert—the most plausible objection—from Suez to the north end of the Bitter Lakes, the sand of the desert near the canal is generally too compact to be raised by the wind. Travelers remark this plainly elsewhere, also on the route from Cairo to Suez. The lakes through which the canal passes will, of course, be unaffected. The only parts of the canal threatened are an extent of about 36½ kilometers (about 22 miles), between Lakes Timsah and Ballah. Admitting the largest calculation in respect of the amount of deposit to be feared on this line, as brought in by the wind or by the waters of the sea, which will enter to fill up the loss by evaporation and by infiltration, or brought in by this entire deposit, it cannot be placed at a higher estimate than 120,000 cubic meters a year. The cost of removing this by dredging would not be more than 250,000 or 300,000 francs.

The objection that the Bitter Lakes will become filled up with salt Mr. Hawkshaw treated as an absurdity. He says:

Before the sea-water can form a deposit of salt it must be reduced by evaporation to at least one-tenth of its volume. When we consider the forward and return currents in these lakes, it is evidently improbable that the quantity of salt deposited will amount to anything considerable, but can be easily removed by the dredges.

In regard to the navigation of the Red Sea, he says:

I am not able to judge how far this objection justly applies to sailing vessels, but I think that such vessels may sail well enough without the aid of steam between Suez and Ras-Mohammed. Captain Harris believes that from Ras-Mohammed to the Straits of Bab-el-Man-deb, also the Red Sea offers no greater difficulty for navigation than the Mediterranean.

The objection has no force whatever in regard to steamers or vessels which have the help of steam.

The objection that ships will fear to approach Port Said is, of course, wholly inapplicable to steamers. Besides, the strongest winds are from southwest by west to northwest, and from these Port Said is sheltered by its situation.

There are not more than four or five gales annually which seriously affect the port, and these are not of a nature demanding extraordinary precaution by sailing vessels. The holding ground of the roads is good, and should the wind blow to the shore there is ample room for vessels to haul off and put to sea.

Mr. Hawkshaw answered the final objection to the canal, that the drifting sands of the Mediterranean would close its mouth, by saying that the westerly pier or jetty of Port Said would arrest the moving sand and bank it up between the pier and the shore. If in the long future it should accumulate enough to reach the end of the pier, the remedy would be to extend it. "The tidal current will be sufficient to keep the mouth of the canal clear and of the proper depth." He closed with the declaration that "he found the plan of the works good, and that they presented no remarkable practical difficulty, but when completed would greatly facilitate the passage to the Indies."

But neither the character of this report, the favorable progress of the work, nor the inspection by the visitors named, effected any change in the policy of the English ministry. Opposition rather increased, the strongest attack being made upon the employment of the fellahs. "This was somewhat remarkable," said M. de Lesseps, "since no like objection had been raised when all the other interior Egyptian works, the railways, canals, &c., had been made on this system of forced labor." On the English work of the railroad from Cairo the English consul had increasingly demanded of the viceroy 2,000, 5,000, and then 10,000 fellahs, urging the necessity for forwarding the Indian mails and making little preparation for the supply of provisions and water; so that at one time one thousand are reported to have perished in a day. It was, however, now convenient to clamor for a suppression of the corvée. The key to this in part seems to have been that England was suffering from the cotton famine, and the viceroy himself was planning its cultivation and that of other products on a large scale, and was not sorry for an excuse to withdraw laborers. In the speech of Mr. Layard the coupling of these English ideas with the Egyptian plans appears plainly in the words that the *corvée* must seriously interfere with the most advantageous occupation for labor; *for instance, the production of cotton.*

Mr. Fitzgerald, in his volumes of 1876, fairly admits that—

Much misapprehension arose from the profuse repetition of the term "forced labor," and people's minds strayed back to the times of the Pyramids, when the natives were employed, with reckless destruction of life; and that a glance at the contract between the viceroy and Lesseps will show that the canal labor was not subjected to any oppressive conditions. By its articles the laborers were paid at a rate higher than that usual in Egypt; the amount of work from each was defined; punishment took the shape of a deduction from wages; the company were bound to provide hospitals and medical treatment gratuitously, and deduct only half wages in case of sickness.

The English Government addressed formal remonstrances to the French cabinet and exerted their influence in Egypt and at the port against the *corvée* and against the possession of the Fresh-water Canal

territory by the Canal Company; and the Sultan, who had visited Egypt, sent such remonstrances to the viceroy that the order to withdraw the *corvée* was made. This act necessitated an appeal; it was claimed to be a violation of a solemn contract. The viceroy consented that the Emperor of the French should be the arbitrator, and at the date of July, 1864, as the result of an examination of the whole question made by a commission under M. Thouvenel, the following judgment was given:

That the concessions of November, 1854, and January, 1856, had the form of a contract, and were binding on both parties; that, as by the withdrawal of fellah labor the cost of the works would be increased, the viceroy should pay an indemnity of £1,520,000 on that account; that the company should cede to the viceroy all their fresh-water canals, reserving only the right of passage through them; that the viceroy should pay £400,000, representing the cost of the construction of the canal, and £240,000 as compensation for the tolls which the company thereby relinquished; that the company should retain only such lands along the line of the maritime canals as might be necessary for the care and maintenance of the said canal; that the company should cede to the viceroy their title to all lands capable of cultivation by means of irrigation from the fresh-water canals, and for which the viceroy should pay £1,200,000.

In the judgment of Mr. Fitzgerald, and as admitted in the discussions at the Institution of Civil Engineers, London, the indemnity, which amounted to a sum of over three millions sterling, did not appear to have been full compensation for the 150,000 acres, the amount of territory taken from the company, who might have reckoned on making very large profits from these tracts which their own works had rendered fertile.* The cost of excavation, also, through the difficutly of obtaining

* The report of United States Consul Farman to the State Department for May 18, 1881, shows the mode of re-excavating and cleaning the inland Egyptian canals in force up to this date.

"Two short canals, the Mahmûdich and the Khatalbeh, which supply the city of Alexandria and the small district of Beherah, require for their ordinary cleaning each year from 25,000 to 30,000 persons for a period of from forty to fifty days. The former of these canals was re-excavated by Mohammed Ali in 1819–'20, who employed in its construction 250,000 laborers for about one year, of whom 20,000 are said to have perished with sickness and hunger."

All the labor for cleaning the canals and repairing the dikes is obtained by what is known as the *corvée*, a system of forced labor. The inhabitants of the fellah class are taken in mass from their villages and compelled to work forty-five days, or more, if required, under overseers and without remuneration. They even furnish their own means of subsistence. They live on the coarsest and poorest food, and sleep on the ground, rolling themselves up in their zaabout, a kind of overshirt, if they are fortunate enough to possess one. During the day the line of the works swarms with busy human beings, and at night the ground is covered with their sleeping forms.

Toil of women.—It is not the male population alone that is engaged. Women and all the boys and girls, down to the age of eight and nine years, are seen carrying baskets of earth on their heads, while the village sheikh stands with his whip ready to chastise the indolent or rebellious. The law mentions only the male inhabitants between fifteen and fifty years of age as subject to the *corvée*, but practically this only serves as a basis for the division of the work according to the estimated amount of

skilled labor from Europe, and the necessary enlarging of the accessory canals for the dredgers, was for a time, three times as great. The company retained, as the indemnity shows, some land besides that on the immediate banks of the maritime canal, as well as properties at Cairo and Damietta. The latest bulletins of the canal of the year 1884 still show small sales, increasing the aggregate of revenue.

At the meeting of the stockholders, March 1, 1864, Lesseps had already announced his entire confidence in the appeals to the French Emperor, whose arbitration, as has been seen, was declared and accepted by the pasha in July following. He had also reported further progress on the work as follows:

The fellahs not yet withdrawn were fully at work between Lakes Menzaleh and Ballah, from the latter of which lakes they had excavated 131,000 cubic meters of gypsum formation. Between Ferdane and Port Said they had dug out 1,200,000 cubic meters. The Fresh-water Canal had reached Suez, and the conduit pipes for fresh water to Port Said were nearly finished. At the port the dredgings of 119,000 meters had raised the foundation of the new city to the further height of 2 meters above the sea level.

The successful prosecution of the enterprise from this date is to be

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cubic meters of earth to be removed. When this division is once made and certain sections of a canal allotted to one or more of the peasant villages, the whole mass of their inhabitants are put to work by the sheikhs in order that they may be kept from their homes and the working of their lands the shortest possible time.

The canals that are dry are cleaned by taking out the accumulation of deposit in baskets carried for the most part on the heads of women and children. In many places there is considerable water and a very thick mud deposit, and this is removed by a man standing in the water and working out with his hand pieces as large as he can conveniently raise, which he tosses to his neighbor standing nearer to or on one side of the bank, whence they are sometimes passed to a third or even fourth person, until they are removed to a sufficient distance. The mud is often left on the bank to dry and afterwards removed in baskets.

The people are always driven to and kept at their work either by or under the fear of the whip. The climate is fortunately mild, but during the winter season the nights are damp and cold, and the laborers on the public works suffer considerably. The hardships of the *corvée* (in Egypt and throughout the Turkish Empire) are very great and have been for a long time the subject of much comment.

For a very interesting detailed report of the present condition of the agriculture, commerce, and finances of Egypt, reference is made to the returns from Consul-General Farman, to be found in Vol. I, 1879, of Commercial Relations, issued by the State Department. Mr. C. S. Hill, in Part II, Vol. I, of his American Statistical Review, makes the following notes:

Labor.—United States Consul Farman, at Cairo, gives officially: "The average pay for agricultural labor in Egypt is 10 cents per day, *the laborer finding and preparing his own food.* He has a mud hut, but no clothes. Slaves are not profitable here, therefore, as they cannot be fed for a less sum."

Mr. Edwin De Leon, late United States consul, in an article to the London International Review, writes of the industry and condition of this people, noting:

"The introduction of gas and water-works into Alexandria and Cairo, of 1,000

credited to the new means, now introduced, to the unyielding perseverance of the company now supplied with increased funds, and to the compromise which had been the result of the English opposition. The viceroy, released from old harassments and able to employ his *corvée* on his own works, was also more disposed from this date to favor the canal.

The sentiment of the English press was still unhappily as unworthy as it was futile. The Standard, the Spectator, the Economist, the Examiner, and the Times boldly declared that as forced labor was to cease the canal ceased. Fitzgerald says that the canal was almost forgotten, its building looked on as Lesseps's mere plaything, and its progress disbelieved in. The *amende honorable*, has now been fully made for these errors; they were not the judgments of the merchant classes.

FULLER USE OF MACHINERY.

The withdrawal of native labor, which has been referred to as occasioning new labors and much delay, resulted in the application of new and powerful machinery. In the year 1864 MM. Borel and Lavalley, of France, contracted for the completion of the greater part of the remaining excavations. A list of the machinery which they constructed and used in completing the canal is given in the official report of 1869. It included 18 smaller and 58 larger dredges, of which 20 were constructed with an iron spout each of 220 feet, the rest tended by large sea-going lighters; 70 barges, built with either under or side doors, for dropping the excavations; 18 elevators; 100 lighters of various kinds;

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miles of railway and telegraph lines, sewerage, paving, and improvements in the latter city, whose European quarter is now quite Parisian, having solid blocks of shops and residences, where ten years ago were mud buildings and trees; several hundred miles of irrigating canals, built recently, palaces, opera houses, and magnificent steamers, and equipages." But with all this, Mr. De Leon adds: "The poor 'fellah,' the producer and cultivator, has been reduced in some portions of the country to actual starvation." The English consul-general, Mr. Rivers Wilson, and the London Times have recently given heart-rending accounts of the utter misery of the people. Speculation and this taxation of the poor benefit England and France.

The reckless expenditures by the pashas of moneys drawn so largely from the oppressed natives appears plainly in some items of the budget of the Government for the year 1880. These are, "salaries of the khedive and various members of his family, $1,575,000." The sum of $200,000 is paid to twelve European comptrollers and commissioners, whose principal, and in some cases sole, business is to watch native officials; their expenses amount to a like sum. The aggregate is double that expended on schools in a population of 5,000,000. The Mecca pilgrimage also cost the Government more than the schools.

The total indebtedness, after the application of all the resources available, does not vary much from $500,000,000, the annual interest on which is about $23,000,000. The tribute to the Sublime Porte is $3,407,430. The Rothschilds hold a debt of about $11,000,000. It is reported by United States Consul Farman that the losses and complications of debt have been brought about, not by the khedives, but wholly by Europeans, so largely profiting by them. (See Commercial Relations, 1879, Vol. I, page 289.)

20 steam cranes; 150 boats for transporting coal; 15 steam tugs, and 30 locomotives.

This machinery represented in all a force of 10,000 horse-power. Its monthly expense was 10,000 francs for coal and 2,000 for oil. The capital employed was 40,000,000 francs in material and 5,000,000 francs in preparatory work. The contractors with this machinery excavated 50,000,000 meters, with the assistance of less than 4,000 men, in the space of less than five years. The day's labor was limited to the time of daylight only.

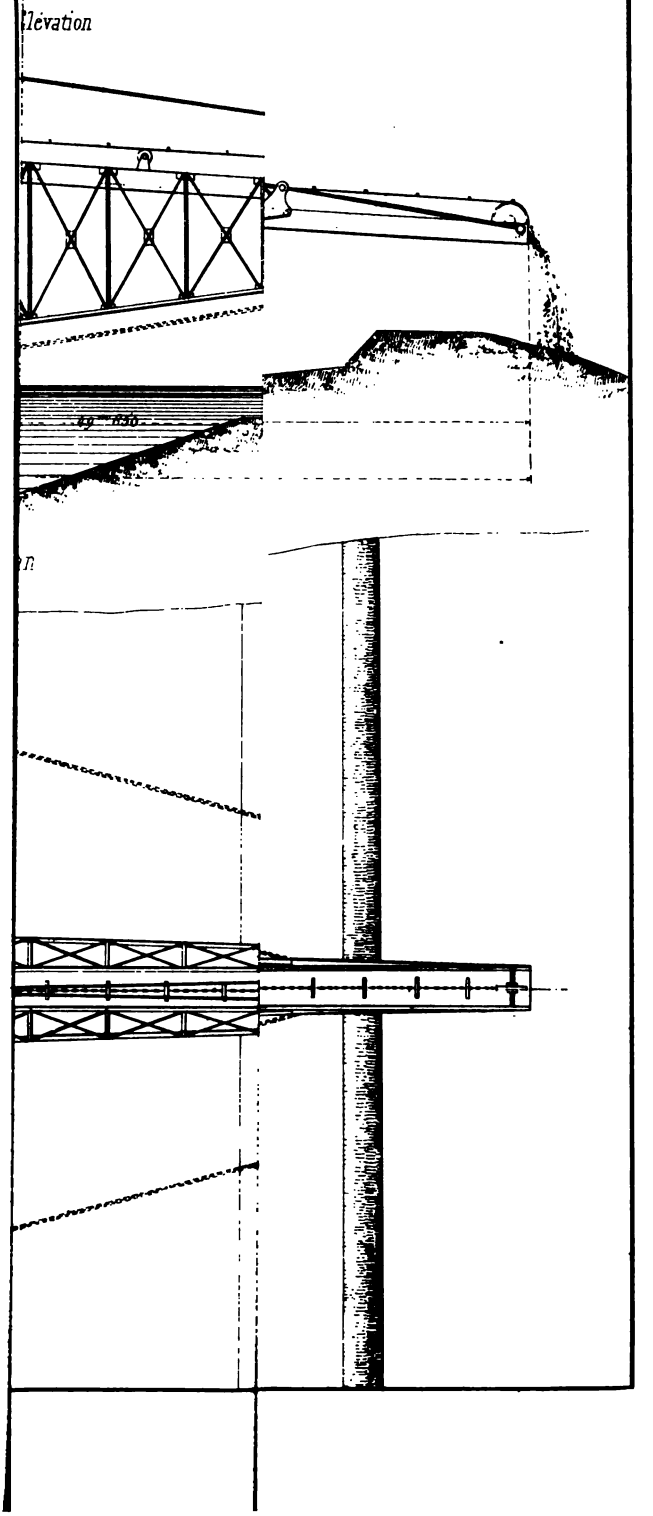
The fine sand at first rapidly cut away the screws and bolts of the machines, but by replacing the iron with steel, they served for the extraction of 37,000 cubic meters for every 1,500 only which at the first had been dredged.

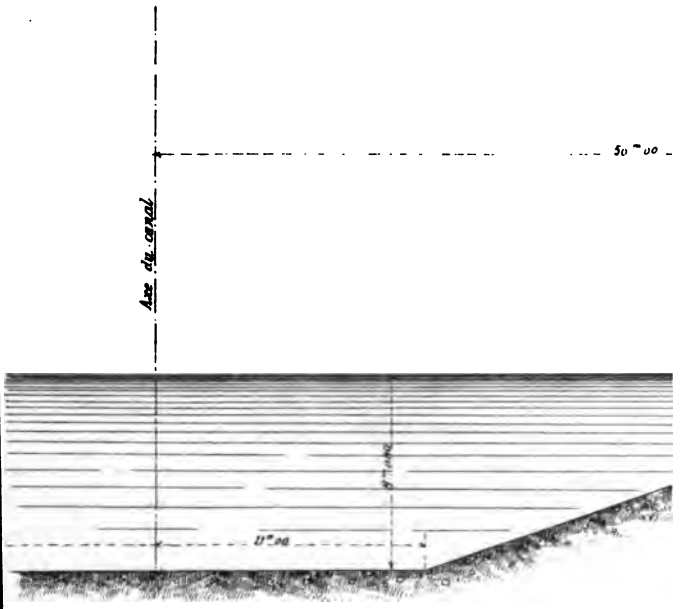
The excess of excavations during the second five years of construction demonstrated the superiority of the machinery over land labor, in part compensating the company for the delays and losses incurred by the suspension of the contract for forced labor. During the last year of the work the monthly excavation exceeded 2,000,000 cubic meters. Three-fourths of this sum was by means of the dredgers, and the remainder by the laborers with carts and wheelbarrows. The "*dragues à long couloir*," (dredges with long spouts) in some cases extracted 100,000 cubic meters per month, the average of twenty-two such machines being 36,000 cubic meters. The consumption of coal was a little over 3.20 kilograms per month.

The forms of dredgers or excavators were called into use as would be expected by the diversity of the conditions of the different reaches of the canal. The chief reaches or sections required the following kinds of machines and work:

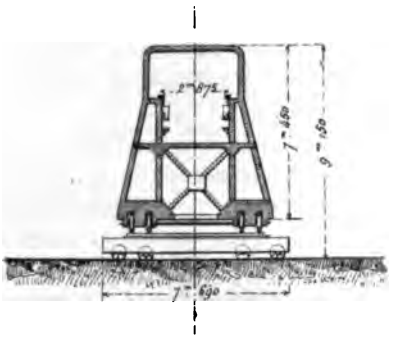
I. For the excavation of the outer and inner harbor, the dredges with endless chains. These dredgers were attended by the usual complement of barges, lighters, or scows which made up the plant. Thirty iron flat boats or scows tended the dredgers in the excavations at Port Said. Their dimensions were 42.50 meters in length by 6.05 meters in width. They were worked by high-pressure engines, and made 3 to 4 knots on their way to the sea.

II. For the sections of the canal on which banks were to be formed, and especially in the lakes, the *dragues à long couloir* were requisite. Their shape was that of a semi-ellipse frame-work supported on an iron ponton, 100 English feet by 30 feet, drawing 4½ feet; their engines 35 horse-power. The elevation of the spout or duct was effected by two hydraulic hand-presses. A rotary pump added water to the dredgings, and *balayeurs* (sweepers), fixed at intervals on an endless chain passing through the center of the duct, secured the delivery of the excavations at a distance of 220 feet. The buckets of the largest size passed at the rate of twenty per minute, each bucket having a capacity of 400 liters or 480 cubic meters per hour.


Élévation



Coupe suivant **AB**



S. EX. 198, 1, 48.

III. For excavations on the undulating sections of the routes, it was necessary, in order to throw the silt over the elevations, to employ different machinery, and the *elevateur* was constructed. This was an elevated railway, supported by iron posts, one resting on a barge, the other on the bank, the whole being joined together by solid cross beams.

IV. In these operations the excavations, after being deposited from the dredgers in loose boxes within floating barges, were raised in boxes out of the barges, made to travel along the elevated railway to a height sometimes as great as 56 feet, and emptied over the bank. The elevation was effected by a system of chains carried by one wheel of the rail-car and worked by a double-cylinder engine whose boiler was in the barge. The engine being then reversed, the boxes were returned for refilling, traversing on their return the under side of the tramway. Eighteen of these elevators with seven hundred boxes were employed with advantage on those sections of the canal where the banks were too elevated to allow the use of the long *couloirs*, and where distances from the sea and the lakes were great.

V. For the excavations near El Guisr, the deepest cutting on the route, the preliminary work required a modification of the machinery elsewhere used. The difficulty of feeding, and especially of giving water supplies to the laborers in the desert, and, at the later dates of the enterprise, the withdrawal of the contingents of laborers by the pasha, necessitated the invention of further new appliances, especially in the deep cuts. In 1865 M. Couvreux invented a dry dredger, which he called an *excavateur chargeur*. This was a dredger mounted on a car which ran on a tramway parallel with the canal. Its chains and iron buckets descended to scoop up the sand, emptying it into cars which were themselves drawn up to the summit of the embankment along a succession of tramways, winding at sharp angles until they reached the top.

When the trench attained a width of 20 meters the excavators deepened it to 2.20 meters below the sea-level. The water then admitted allowed the use of the ordinary dredgers and hopper-barges, which emptied the dredgings on the border of Lake Timsah.

In the Naval Museum of the Louvre (*Salle de Lesseps*), in charge of the *conservateur*, models of these machines were on exhibition in the year 1875; during the Exposition, under the International Geographical Congress of that year, they were transferred to the halls of the Tuilleries. A descriptive memoir of the canal and of these machines which accompanied their exposition was indorsed by the Canal Company as the accurate work of Vice-Admiral Paris, the *conservatoire*.

The plans of some of the machines to be found on the preceding pages were furnished by the Suez Canal Company in 1875. The marine dredger to which reference has been made was built by the company at a cost of $140,000.

THE CHOLERA.

The employment of the effective machinery, which has been described, in place of the native labor withdrawn, necessitated still a considerable amount of manual labor, which was introduced from neighboring countries, a few of the workmen coming from France and England; a portion of the works was still to be executed by hand only. To add to the embarrassments of the year 1865 the cholera, introduced on the Isthmus by the pilgrims to Mecca, broke out in June at Alexandria, and created a panic among these foreign workmen, leaving the company destitute of more than 4,000 hands. M. de Lesseps answered the telegraphic announcement by repairing to Egypt and establishing a medical hospital in Alexandria, with ambulances and necessaries for the sick at Cairo, Ismailia, Port Said, and other points on the line. By July 24 the workshops were again filled.

Previous to this visitation a second inspection of the line of the canal had been made at his invitation by delegates from the chambers of commerce and shipping firms from the United States, Brazil, England, France, and other countries of Europe, and from Persia. The pasha gratuitously put every means of transportation at their disposition. At the close of the inspection Mr. Cyrus W. Field, of New York put into Lesseps' hands a paper signed by himself and seventy other delegates, expressing their conviction that all those who had seen what they had witnessed must believe in the final execution of the work. They had passed along the canal in twenty-seven hours, and were well satisfied with its progress and with the machinery in use.

Sir Henry Bulwer, on this, his second visit, expressed himself thus:

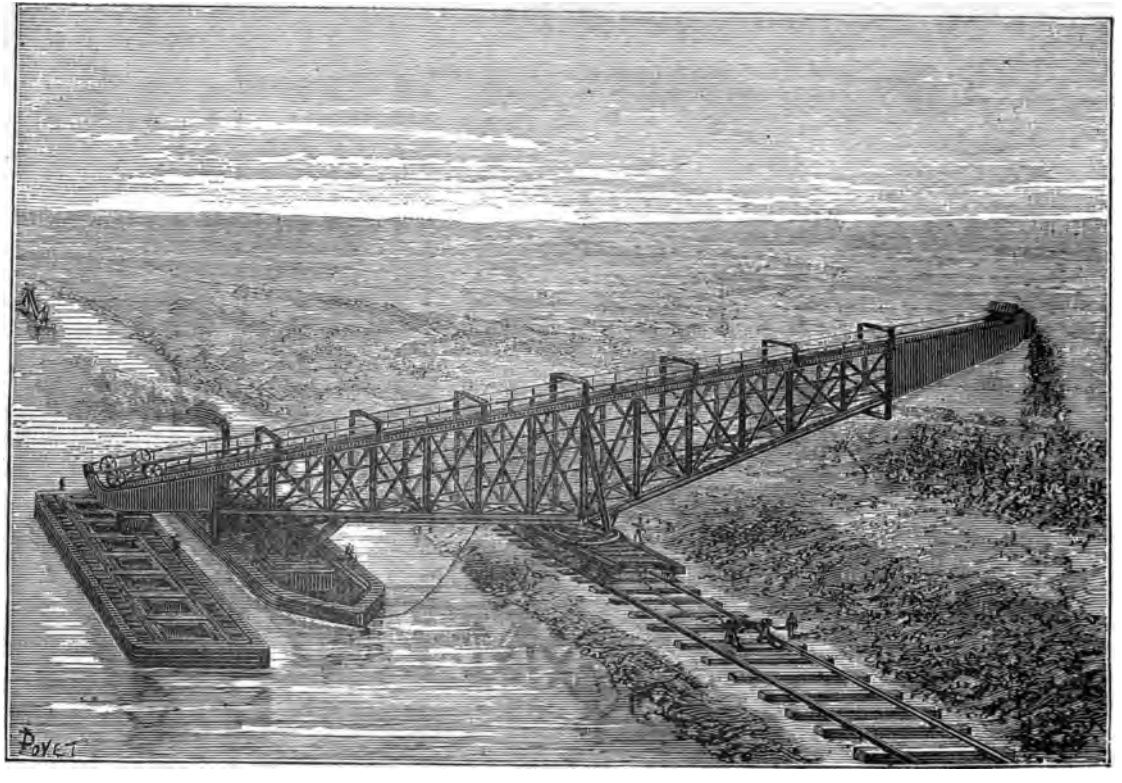
> On my previous visit I said that there were circumstances which did not permit a diplomat to tell all he thought. To-day, I am happy to say, I can speak more freely. All that I have just witnessed makes me confident in the success of the enterprise and inspires me with sentiments of its grandeur.

FIRST TRANSITS THROUGH THE CANAL.

December 9, 1865, a steamer drawing 4 meters only entered Port Said from the Mediterranean. December 24 the transport schooner, the Eugenie, passed in twenty-seven hours from the Mediterranean to the Red Sea.

THE SULTAN'S FIRMAN.

The long-delayed authorization was at last issued March 19, 1866. It was the result of a convention satisfying England and the Porte. It named the canal as "the realization of the great work destined to give new facilities to commerce and navigation," and as "one of the most desirable events in this age of science and progress, the present firman emanating from our Imperial Divan and delivered to this effect, that



ELEVATEUR FOR LANDING AND DUMPING DREDGINGS.

we grant our sovereign authorization for the execution of the canal on the prescribed conditions."

February 11, 1866, merchandise sent by the King of Siam passed from the Red Sea to the Mediterranean, under the inspection of the governor of Bombay, who was visiting the works. On the 18th a transport of 80 tons passed through. In November and December the small English steamer, the Prompt, and a French and Grecian transport passed in thirty-two hours.

The annual report of the stockholders, made in June, 1868, showed so favorable a situation of the enterprise of the canal that the legislative bodies of France authorized the company to make a new loan of 100,000,000 francs, which loan was readily effected.

1869—THE FILLING UP THE BITTER LAKES.

The process of letting in the Mediterranean Sea water into the empty basin of the dried-up Bitter Lakes was of necessity to be gradually performed. It was calculated that the filling of these, 40 leagues in circumference, would require 440,000,000,000 gallons. These lakes once full, a single barrier beyond Chalouf would be all that would restrain the full mingling of the two seas. The *barrage* which had prevented this flowing into the lakes by an impetuous and destructive torrent was cut away in part March 18, 1869, in presence of the viceroy, the Prince and Princess of Wales being present also, as has been stated, on their return journey from India. The pasha telegraphed to his minister at Paris that he was full of confidence as to the early opening of the canal. The French Emperor and Empress sent their congratulations to Lesseps.

The viceroy now entered into new arrangements of importance to the canal interests and surrendered to them his coupons of interest to fall due in the subsequent twenty-five years on his 176,602 shares of stock in the work. The telegraphic announcement of this to Paris effected a new issue of stock,,subscribed in less than one hour, on the mortgage of these retroceded coupons.

The viceroy fixed the 17th of November of this year for the formal opening of the canal, and M. de Lesseps gave notice of this to shippers, advising them that all vessels presenting themselves at Port Said or Suez, on the 17th, 18th, 19th, and 20th of November would pass without charge. From the 21st of November the transit charges would be according to the provisions of the concession—"10 francs per head for passengers and 10 francs per ton, following the legal registry of each flag." The expenses of port charges, piloting, and towing were to be promptly announced.

September 28, 1869, he telegraphed as follows:

SUEZ.

We left Port Said this morning, and after an uninterrupted voyage by steam arrived here in fifteen hours.

This was the reward of his labors begun in 1852 upon ideas first entertained in 1831 on reading Le Père's report:

AMOUNT OF EXCAVATION BY DREDGING.

(From Letters, Journal. et Documents, tome v, p. 389.)

In a *résumé* by M. de Lesseps, April 10, 1870, he gives a forcible idea of the dredgers and of their work, which "had no precedents in the history of industry:"

Our dredgers, whose ducts which were one and a half times as long as the column in the Place Vendôme [a column 134 feet in height], carried aft from 2,000 to 3,000 cubic meters a day; and as we had sixty of them, we succeeded in extracting monthly as much as 2,000,000 cubic meters (about 2,763,000 cubic yards). [The total excavation was 80,000,000 cubic yards.]

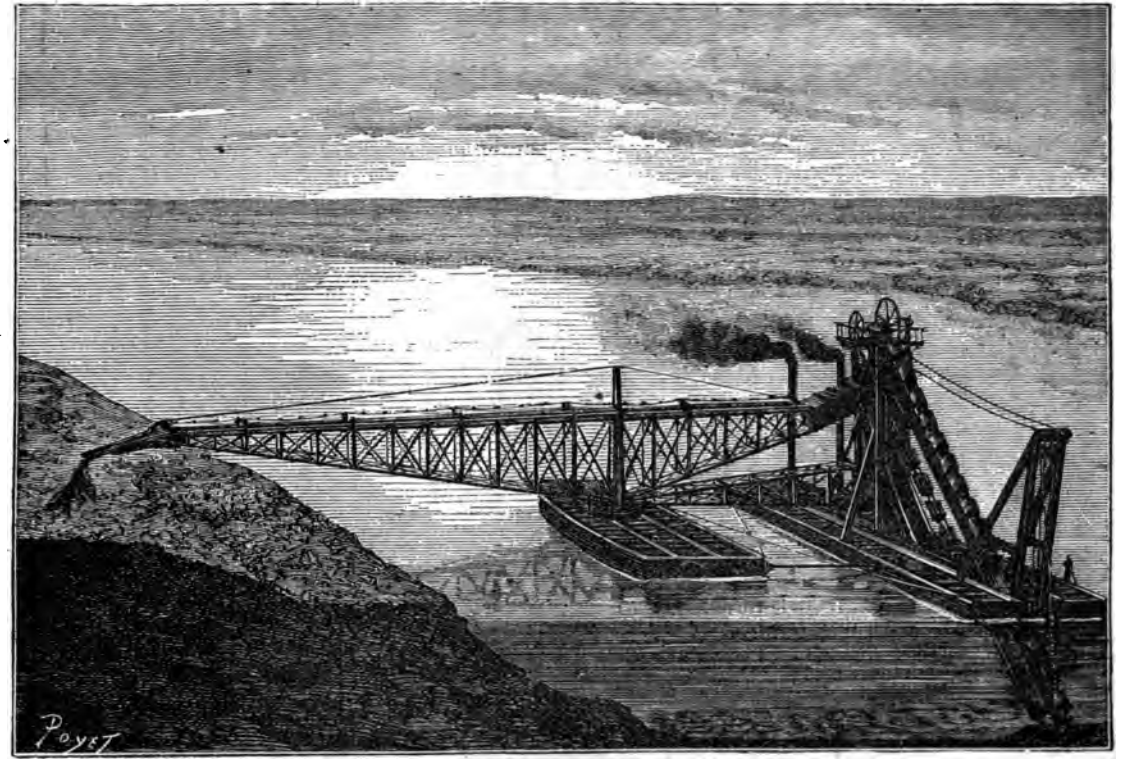
This is a quantity of which no person can form an exact idea. Let us try to realize it by comparison. Two million of cubic meters would cover the whole of the Place Vendôme, and would reach an elevation of five houses placed one on the top of the other. They would entirely cover the Champs Élysées to the top of the trees between the Obelisk and the Arc de Triomphe; or, the whole boulevard from the Madeleine to the Bastile, as high as to the first stories of the houses. It took four months for the 400,000 cubic meters of the Trocadero, while we dug out 2,000,000 in one month.

In one of the "conférences" held at Vincennes under the patronage of Eugénie, just before opening of the canal, he says that his problem had been to transform the Isthmus into a "véritable strait, 160 kilometers in length, 100 meters in width at the water-line, and 8 meters at bottom;" that to do this work it was necessary to excavate 74,000,000 cubic meters, 100 leagues from France, in the midst of a desert where there were no habitations nor water to drink; and that the "material" employed upon the work represented more than 100,000 men, consuming coal to the value of nearly a million of francs a month. The cost of the plant when introduced was about ten millions. Referring to the European workmen employed, he said that they worked securely in the workshops and on the dredgers, but could not excavate such a vast amount under the burning sun of Egypt; but added that the annual mortality on the Isthmus was only 1.85 per cent., while in France it was 2.40 per cent.

INAUGURATION OF THE CANAL, NOVEMBER 17, 1869.

This event, long awaited with intense interest, drew into Egypt and to the Isthmus a very large concourse. The viceroy, with lavish expense, caused preparations to be made for the reception of at least six thousand guests, for whose entertainment he brought together five hundred cooks and one thousand servants from Trieste, Genoa, and Marseilles. On the borders of the Fresh-water Canal and of Lake Timsah were also twenty-five thousand Arabs ready to show the hospitality of the tent.

In the harbor, by the 14th, eighty ships had anchored, and outside, at



Drague à long couloir (Dredge with long spout).

a distance of 4 kilometers, were two large English iron-clads. Fifty of the ships were war vessels. Preceding the day of inauguration extended religious ceremonies, introduced by the prayer of the Musselman, embraced a discourse in Arabic by the *Grand Ulema* and a *Te Deum* chanted by the Christian clergy, closing with a brilliant allocution by M. Bauër, apostolic prothonotary. At these ceremonies the khedive, the Empress Eugenie, and the Emperor Francis Joseph of Austria were present and were severally addressed by the orator.

On the eve of the day of opening the canal exaggerated and false reports of its failure had been circulating at Cairo, at Alexandria, and in Paris, "that the empress and the Austrian emperor had returned; that an enormous rock had intercepted the passage, and a fire destroyed Ismailia; that M. de Lesseps had lost his mind, and the contractor, Luvalley, had killed himself in despair; so that the worst of deceptions was awaiting the concourse that had gathered." A fire which had broken out in the suburbs of Ismailia on the 15th, originating in an explosion of fireworks which had been prepared for the ceremonies, had been promptly arrested by the labor of two thousand Egyptian troops. The wind falling, the town had been saved.

On the 16th one hundred and sixty vessels had arrived, but on the evening of that day Lesseps learned that the Latif, an Egyptian ship, which had been sent forward with the French war ship Salamandre to explore the route, had grounded between Port Said and Kautara. The Salamandre had gone forward without difficulty. The khedive himself immediately hastened to the spot, and under his own direction the Latif was floated and stationed in one of the gares at Kautara to salute the fleet of the following day. The rumor of blocking the canal by a rock had this foundation: that a bowlder rising 5 meters from the base of the channel had been discovered some fifteen days previous and had been blasted.

At 8 a. m. on the 17th a fleet of ships, headed by L'Aigle with Lesseps and Eugenie on board, prepared to pass through. The length of L'Aigle was 99 meters and its beam 18 meters. In 4 hours it made 44 kilometers, reaching Kautara to receive the salute of the Latif. In the rear of the L'Aigle followed the Emperor of Austria; in their own yachts, the Prince Royal of Prussia, the Prince and Princess of Holland, the English ambassador at Constantinople, Lord Elliot, and the Russian ambassador at the same court, General Ignatieff. These were accompanied by the engineers of the canal, Voisin Bey, La Roche, Gioia, and others; the Prince of Holland by M. Ruyssenaers still the consul-general, and then vice-president of the Canal Company. After a delay at Ismailia, where a ball at the palace was attended by from four to five thousand guests, the fleet passed forward, L'Aigle, with the Empress Eugenie, reaching Suez on the 20th.

One hundred and thirty vessels were numbered on the route from

Port Said to Suez and on the return. The transit was free for all during the three days of the ceremony.

Congratulations immediately poured in upon M. de Lesseps, among which are found those from the chief commercial chambers of Europe, but perhaps those most acceptable were the dispatches received from Lord Clarendon in the name of Her Majesty, and from the Government of British India. The latter of these read thus:

Success to the gigantic work of peace so well executed by the French for the benefit of the world.

No American vessel had been present. The United States flag floated over the consulate at Port Said. The following letter from American citizens present at the celebration was addressed to M. de Lesseps:

M. FERD. DE LESSEPS,
President and Founder of the
Compagnie Universelle du Canal Maritime de Suez:

SIR: The undersigned, citizens of the United States of America, present to you their congratulations upon the great success which has attended the inauguration of the maritime canal across the Isthmus of Suez. The people of the United States are interested in every enterprise which promotes the free intercourse of nations and enlarges the commerce of the world. The work which has been completed under your direction is eminently of this character. It removes one of those barriers which, interposed, are said to make enemies of nations. It fosters hope of universal peace. Opening the way to a freer exchange of commercial products, it will increase the wealth and prosperity of nations; and, beyond this, it unites by closer ties the eastern and western hemispheres, which have been so long separated by the Isthmus, now happily intersected. Religion, civilization, commerce, and enlightened government ought to be promoted thereby. In this aspect we regard it as one of the most important works which in any age has been initiated by individual enterprise; and, with a full recognition of that which is due to you and to those associated with you, and a profound respect for the governments which have rendered assistance, we present our congratulations upon its complete success, and trust that it may realize all the anticipations which have animated and sustained the company under whose auspices it has been completed.

N. P. BANKS.
DR. THOMAS W. EVANS.
GEORGE EUSTIS.
DR. H. W. HARKNESS.
HOWARD M. TICKNOR.
DR. EDWARD A. CRANE.
SCIPIO LEON LESLIE.
NATHAN APPLETON.
LYSANDER DICKERMAN.

The highway of the East was now open. It is remarkable that at this same date the statement appeared in one of the leading English Engineering Journals, "the canal is a nuisance!"

THE FRESH-WATER CANAL (CANAL D'EAU DOUCE).

The course of the Ismailia conduit, as it runs at present, takes the shape of an arc. It begins at Cairo, ascends to Ras el Wady (or Ouady), and descends again to Suez, after shooting out a little branch to Lake

Timsah. The extent from Cairo to the lake is 135 kilometers by a northeast course. Originally, advantage was taken of a branch of the Nile, which came from near Zagazig; but as this course was attenuated and liable to run dry, from having to pass through many channels, it was later determined to draw the water from the main stream itself at Cairo. The short length of canal joining Lake Timsah and Ras el Wady was likweise 20 miles; it was 8 feet deep and about 60 wide. The total cost was about £280,000.

The first idea had been the rude one of a stream of fresh water from end to end to end of the whole work, carrying the Mediterranean water along the track of the maritime canal; but the happier thought of supplying the northern half of the main work by distillation, chiefly at Port Said, saved the construction of the northern part. Previous to this distillation eight hundred camels had been daily employed to go and come, sometimes, a distance of 30 kilometers. The camels moved in caravans of ten to twenty; and at one time there came to be a necessity of employing as many as two thousand. Distillation processes afterwards supplanted largely the use of the camels; but as soon as the Nile water reached Lake Timsah pipes from the water-tower, which has been spoken of, were laid down along the main channel, fully supplying 20,000 inhabitants of Port Said, and the construction of the Fresh water Canal from Lake Timsah to Suez was all that remained necessary. This southern branch was completed December 20, 1863, up to which time the cost of the water supply for the town had been more than 1,200,000 francs a year. This canal belongs to the Egyptian Government. Negotiations for the construction of a canal from Ismailia to Port Said are in progress.

At Lake Timsah the canal joined the northern portion of the main channel by a double lock, the level of the Nile being 17 feet above that of the sea. Above the locks arms branched out southwards on this same level above that of the maritime canal.

ISMAILIA.

A visitor to Ismailia, writing in 1869, says:

The new town of Ismailia has now more than 6,000 inhabitants, of whom more than a third are Europeans. [This population was, however, but temporary.] Two hotels, four or five cafés, a theater where vaudevilles are performed with spirit, a pretty Catholic chapel, a mosque for Arab workmen, a hospital, and a telegraph office, a long and well-built street with numerous well-stocked shops, a large square, and a public garden planned by French taste and cultivated with French assiduity, a fountain supplied with Nile water—these are the features which attract the attention of the stranger as he wanders through the town. The rapid increase of vegetation since the fresh water was brought to Ismailia has been attended with a great improvement in the climate. At the present time Ismailia, during eight months of the year, is probably the healthiest spot in Northern Egypt.

The heat of its summer is intense and almost intolerable. Thermometrical observations, taken during 1867 and 1868, show that the mean temperature of the four months, beginning with June and ending with September, was 94° Fahr., and that [illegible]

the shade was not an uncommon record, while the minimum of night was 75°. The mean temperature of the succeeding four months was 74°; and the winter, if so it can be called, proved that the lowest range of the thermometer was 45°. Until two years ago, rain was unknown, but in the twelve-month ending April, 1868, there were actually fourteen days on which rain fell, and no later than three weeks ago fell a tremendous shower of rain, a phenomenon which the oldest Arab had never previously witnessed.

The influence of the Nile water on the section of Egypt through which the canal passes eastward has been fortuitous. This valuable addition to the irrigation of Lower Egypt is spoken of in the annual report of the Société de Géographie for 1881, as having modified the climate. Rain has become no novelty on this canal line.

The student of Egyptian history and of biblical research can scarcely fail of being interested in the notes of the first exploration of the old land of Goshen, now reclaimed, which he will find in Vol. I of "Lettres, Journal, et documents." Lesseps begins these notes near "Pihohiroth" with the words "C'est maintenant le cas de transcrire les versets de la Bible qui parlent de la terre de Gessen." He comments with much interest on the chapters of Genesis, which describe the journeyings of the Israelites on the Exodus, his knowledge of Arabic serving him for some identifications of places by the correspondence of their Arabic names with those found in the Hebrew Scriptures.

CHAPTER III.

THE CANAL FROM ITS OPENING, 1869, *TO* 1884.

The work still incomplete.—Need of funds.—New arrangements with the khedive.—Demands of commerce.—Increase in the number and tonnage capacity of steamers.—Dues levied on gross tonnage.—Disputes.—Decisions of the International Commission, 1873.—De Lesseps's protest.—Troops sent to the works by order of the Sultan.—The company forced to yield.—Mode of levying the dues since 1875.—Transit of United States ships: The passage of the Palos in 1870; of the Iroquois in 1872; of the Tennessee, 1875; of the Alert, 1876; of the Pacific mail steamers Alaska and Arizona.—Reports on the canal by United States Consuls Farman and Wolf.—Report of Sir John Stokes, one of the British directors.—Delays by quarantine.—Storms at Port Said.—Letter in the London Times.

IMPERFECT STATE IN 1869.

The obstacles to be overcome before full and ready transit could be secured for an increasing trade, were chiefly the still imperfect state of the work, as was indeed anticipated, the unsettled problem of the interpretation of the term "tonnage," and some incomplete arrangements with the pasha. The last of these is thus referred to by an English writer, Mr. Fitzgerald, and by the under-secretary of state for England:

The company were in want of money to complete the works, and the khedive was probably anxious to recover some of his rights to his landed estates. He purchased the right of levying tolls and navigating the Fresh-water Canal, which canal had been transferred to him by the decision of the Emperor, for the sum of £400,000, paying for this and for the right of fishing in the canal and in the Great Lakes the further sum of £400,000, while for the hospitals and magazines at Damietta and Boulak he surrendered to the company his coupons from his own bonds for the succeeding twenty-five years to the year 1895.

When on these bonds the company had issued new bonds or "*delegations*" their true value came into dispute. A reduction in their value was asserted to be just, since the Egyptian shares, separated as they were from their coupons, could not be represented in *assemblée générale*, and the coupons themselves could not separately be recognized. The question was, could the viceroy be represented in the votes of that assembly. This was finally admitted. As will be remembered, the sale of the khedive's shares to England by the logic of this decision and of events brought to England the inheritance of a representation in the assembly which increases and largely tends to her ultimate virtual control of the route. The question of interpreting the *tonnage de capacité* brought on embarrassments protracted to the year 1875, and renewed even as late as 1878.

They were finally settled only by an International Commission. The relations between the natives and foreigners, increased by the construction and use of the canal, occasioned also the establishment of more settled bases by the establishment of the international "mixed" courts of justice still in exercise.

1870 TO 1872.

According to the report made to the Navy Department by Commander Beardslee, of the United States steamer Palos, an abstract of which will be found further on, the greatest draught of a vessel passing through the canal in 1870 was 22 feet, and this with care. The greatest depth permissible in 1871 was 7.21 meters, or 23.6 feet. This draught was probably not utilized. The tonnage of the year 1871 was 761,467 tons, nearly double of that of 1870. An increase in the number of ships expecting to use the route was clearly perceptible.

At the *assemblée générale* of 1872 the channel was reported as having from the jetties to Suez a depth (mean) of 8.30 meters, the engineers expecting to be under the necessity of expending annually the sum of 825,000 francs to keep this open.

Five curves were also to be widened and several sidings to be enlarged. The total outlay for the succeeding year was to be 15,000,000 francs. A new loan of 20,000,000 francs had been voted by the council of administration. It was therefore clear that the position of the stockholders was a sensitive one, no dividends being as yet earned. This state of their interests prompted the disposition to contest with vigor for the company's interpretation of the tonnage question.

THE POSITION TAKEN BY ENGLAND.

Mr. Fitzgerald, referring to this as in charge of the British under secretary of state for foreign affairs, says:

In the concession it was laid down that the maximum charge was to be ten francs per ton "of capacity."

This description "tonneau de capacité," though apparently not without ambiguity, was made certain enough for all practical purposes by the general custom of the great maritime powers. The question of ascertaining by measurement the amount of goods a vessel could carry, in other words its size, had always been an intricate one; for though a rule of measurement had been laid down, the ingenuity of ship-owners and ship-builders was set to work to contrive additional accommodation which should yet fall without the rule of measurement. This will be better understood by what was attempted in the case of telegraphs, when what might be called the duty was paid on each separate word, but by a code of arbitrary signs a single word of six letters was made to do duty for six words. In the same fashion a vessel registered at, and paying duty on 100 tons might really carry double that amount of goods. Again, there was the space for sleeping cabins, and, in the case of steamers, of the engine-rooms and machinery, &c., which should be deducted, as no cargo could be carried in such compartments. The practice of England, as being the largest ship-owning nation, was naturally followed; and before long an agreement was made between France, the United States, Austria, Italy, Holland, Denmark, and Germany, who were the leading maritime powers, to adopt the English mode of estimating the size of the ship as being the one that most nearly reached the true capacity of the ship. This was known as the Moorsom system. It had been adopted by the shipping act of 1854, and was of the simplest kind. The gross tonnage, that is, the capacity of the ship cleared from end to end, was ascertained; half this amount was taken off in the case of a sailing ship to allow for cabins, ballast, &c., and in the case of a steamer about one-fourth was deducted for the engine-room, &c. The

balance, which was 37 per cent. of the whole, was inscribed on the ship's papers as her "net tonnage," and on this the toll was paid. The French method, as might be expected, was more scientific and based on a regular calculation, the dimensions being multiplied and divided after a formula. The English mode, however rough, has the advantage of simplicity.

The under secretary, Lord Tenterden, in the Parliamentary Papers for 1874, states, that until the year 1872 the due of 10 francs per ton was levied by the Suez Canal Company on this net registered tonnage, as shown by the ship's papers, but that the resolution adopted by them March 4, 1872, construed the "ton of capacity" to mean the real capacity of the ship. They also claimed that the real capacity of vessels had been ascertained to be greatly in excess of the net register tonnage; that the English gross tonnage was not fully measured, and that 30 per cent. should be added. They then allowed 25 per cent. deduction for English space, &c., the result being to levy the dues on the entire gross tonnage with the effect of raising them 30 per cent.

The discussion of the question was brought to its first issue by the decision in favor of the Messagéries Impériales in 1873. The court of appeals decided in the following year that the true interpretation of the term of capacity was found in the ordinance of Colbert, 1681, to be "the cube of 1 meter 44 centimeters, a measure of space or volume in opposition to a ton of merchandise of weight. The Canal Company were cast in this suit.

The dispute, which need not be detailed here in full, was carried on with great earnestness between the company and the British Government in support of its shippers, and was practically settled, so far as decision should be reached by an International Commission of Representatives of the European Powers, meeting at Constantinople in October, 1873.

M. de Lesseps protested against the report of this Commission as a violation of the provisions of the concession, and declared that he "held the Porte responsible for all losses resulting from this *application* of the tax of 10 francs, according to the inaccurate calculation of the International Commission, instead of the ton of real utilizable capacity fixed by the concession." The losses were estimated at 700,000 francs a month. He declared his resolution to resist any measure that might be adopted to enforce the new rule, even if it were necessary to abandon the canal, withdrawing the *personnel* and employés and extinguishing the lights, &c., thus closing navigation.

Finally, the Viceroy of Egypt, by advice from the Porte under the influence of England, in April, 1874, sent 10,000 troops, under General Stone, from Cairo to the canal, and an English officer in the Egyptian naval service with a frigate to Port Said to insure that the mouth of the canal should be kept free. Under this application of force, Lesseps announced that "under protest, reserving all rights of the shareholders the tariff of the special navigation would be applied with the surtax."

The surtax was 4 francs on the net register, to be reduced in certain circumstances to 3 and to 2 francs when the net tonnage passing through the canal in a year should reach 2,200,000 tons.

The company, claiming it as a just protection to their rights, continued to make their own measurements of the ships passing through, although this was in opposition to that part of the report of the International Commission which read, "the certificate of registry, delivered by the competent Government authority, shall be officially recognized as the true basis for the application of ships, dues, and taxes," and in this connection it may be here stated that the log of the U. S. S. Kearsarge, of November 3, 1877, records, "Officers of the Canal Company came aboard and measured the vessel."

Some equitable reasons seem clearly to have existed for this endeavor on the part of M. de Lesseps to collect the full dues for transit of ships through this new saving-distance route. He was well apprised that, among the British shipping especially, gross discriminations made in the matter of registered tonnage were admitted and complained of by even British merchants at home; a vessel registered for 2,000 tons openly showing at Port Said that the figures should have been 3,000. He was still more clearly in the right when he claimed to apply the tax of 10 francs a head to the soldiers of the British troop-ships, which, it was strangely at first contended, were not passengers. The necessities of the canal were also urgent. On the one hand then, sufficient revenue must be obtained in justice not only to the stockolders but to the completion of the canal; on the other it was the interest of British shipping, amounting to seven-tenths of the whole tonnage, to secure the most equitable charges. At the date last named these amounted in all to 14 francs per ton. Happily for all parties the largely-increasing traffic has brought to the stockholders handsome dividends, notwithstanding the different loans authorized. At the date of January, 1882, the shares of the Canal Company were among the first to recover from the financial shock existing in Paris. They command for the English Government the large profit of several million of pounds.

MODE OF LEVYING THE DUES SINCE 1875.

The actual practice of the Canal Company may be learned from the papers which are furnished to ships entering Port Said. A copy of one of these papers furnished to the U. S. S. Alert, July 22, 1876, has the heading, "Mode of levying the dues enforced on the company, April 29, 1874, and against which Mr. de Lesseps protested on the 26th of said month." The paper states, the dues as measured by the Moorsom system and those measured by any other system with the "provision common to all vessels;" the decrease of the surtax of 4 francs proportionally to the increase of traffic, and other terms recommended by the International Commission being stated in full. The mode of levying began January 1, 1875.

The sixth article of the final paragraph of these papers provides that—

Ships of war, vessels built or chartered for the transport of troops, and vessels in ballast shall be exempt from all surtax; they shall not be liable to a tax greater than the maximum of 10 francs per ton, which shall be levied on their net registered tonnage.

As regards the dues paid by the United States steamship Alert, the account presented by the treasurer of the company at Port Said shows that the measurement of the Alert (by United States Navy register 541 tons) was reduced to net Danubian tonnage 391.82 tons.

The account reads as follows:

Particulars of tonnage.		Tons.
Under tonnage deck		621.53
Space on deck		48.91
Gross tonnage		670.44
Deductions allowed:		
Engine space, propelling power	345.10	
Crew space	33.52	
		278.62
Net Danubian (?) tonnage		391.82

The Pacific mail steamship Alaska, a note of the passage of which will be found further on, had a registered tonnage of 4,011 tons; measured by the company's officers at Port Said March 5, her tonnage was charged to the amount only of 2,096 tons.

THE CANAL FROM 1870 TO 1882.

The actual conditions of the canal from 1870 to the date of 1882 will probably be well learned from the papers which follow, viz, the reports of the commanders of United States vessels passing through, and those from the British and United States representatives in Egypt.

TRANSIT THROUGH THE CANAL BY UNITED STATES VESSELS.

The following-named national vessels of the United States passed through the canal on their outward or return voyage between August 13, 1870, and March 16, 1880. The detailed items below have been furnished from the respective log-books by Mr. F. Hamilton, of the Bureau of Navigation:

Name.	Rate.	Tonnage.	Entrance port.	Date.	Total expense.
Palos	4th	306	Port Said	Aug. 13, 1870	$692 58
Saco	3d	410	do	Dec. 27, 1871	841 09
Iroquois	3d	695	do	May 30, 1872	1,472 04
Hartford	2d	2,211.49	do	Jan. 10, 1873	4,413 90
Do	2d	2,211.49	Suez	Aug. 6, 1875	3,315 20
Tennessee	2d	2,080.59	Port Said	Aug. 14, 1875	4,290 30
Alert	3d	391.82	do	July 23, 1876	840 13
Kearsarge	3d	695	Suez	Nov. 3, 1877	1,278 54
Ranger	3d	541	Port Said	June 13, 1877	658 86
Monongahela	2d	960	do	Dec. 1, 1877	1,247 28
Tennessee	2d	2,840	Suez	Apr. 24, 1878	4,296 18
Richmond	2d	2,000	Port Said	Mar. 15, 1879	2,165 38
Swatara	3d	910	do	Mar. 16, 1880	1,483 13

The logs of these ships show, so far as the times of their underway are given, that these were for the Palos 17 hours, the Tennessee 19 hours, and the Ranger 17 hours 10 minutes. The longer times occupied by stoppages for different reasons on points in the canal were those of the Hartford, the Richmond, and the Kearsarge; of these the Hartford "touched bank of canal in avoiding a vessel." For the Kearsarge and Richmond the following notes are given:

Kearsarge, Commander F. V. McNair, November 4, 1877:

At 12.05 p. m. ship went aground on the east side of the canal, just above station Kabret and off a sand bank on the west side. The wind was blowing fresh from northward and westward, and the ship set bodily over to east side of the canal.

Under direction of commanding officer made all preparations necessary for getting the ship off the ground. Shifted battery forward and worked the propeller, got stream anchor ready for carrying out. At 1.20 succeeded in floating her astern when we steamed ahead into channel.—J. P. WALLIS, *Lieutenant.*

Notes of the Richmond, Capt. A. E. K. Benham, March 15, 1879:

At 8.40 a. m. started ahead from buoy, conned by pilot down Suez Canal. At 10 went aground on right bank of canal. Cause, ship got yawing in trying to clear a sail boat. Remainder of watch getting out hawsers and trying to get her off. Draught, forward, 17 feet 1 inch; aft, 17 feet 6 inches. At 1.45 p. m. hauled off and steamed ahead again. At 3.50 moored to bank to let steamer pass.—N. J. K. PATCH and S. H. MAY, *Lieutenants.*

The log of the Swatara reads:

Blown against shore. Anchored at Ismailia from 6 p. m. March 16 to 10 a. m. March 22.

The greatest draughts of the vessels here named, so far as obtained from their logs, were of the Tennessee 22 feet 3 inches aft; of the Swatara 18 feet aft, 15 feet 6 inches forward; of the Monongahela and the Richmond 17 feet 6 inches aft.

The details of the expenses of these vessels may be learned from the following items: For the Palos the total was made up of canal tolls at $2 per ton and pilotage $692.58. For the Iroquois (port charges four days $10.36) tolls at $1.90.9 per ton and pilotage. The *pilotage* of the Alert was $82.41; of the Tennessee, $276.95.

PASSAGE OF THE PALOS, 1870.

Of the passage of the first of the vessels which have been named (the Palos), Commander L. A. Beardslee made notes of interest in his report to the Secretary of the Navy, dated August 22, 1870. He says:

Running by the revolving light on Damietta Point, the Palos saw the very brilliant electric flashing light of Port Said visible over 20 miles, and in the morning made the light-house, the shipping-houses and piers, and anchored in the basin. Port Said was an easy place to find; the soundings and landmarks give a position, and the shipping and light-house being as easily discovered as a fleet of ships would be a few miles off.

The entrance to Port Said is through the maritime channel, which extends 1¼ miles to seaward, and is kept with little trouble to a uniform depth of 26 feet,

for 600 feet in width. It is marked with red buoys on the western side and black on the eastern. At the extreme outer and inner buoys are moored light-boats, which show at 10 feet above the water, each two lights, red on the west and white on the east. The channel is protected by two piers, and runs nearly parallel with the western one, converging from about 800 feet distant at the outer end to 400 at the inner.

The eastern pier, 5,910 feet in length, has a green light on its outer end, at which it is distant from the western 2,298 feet, diverging to seven-tenths of a mile at its inner end. Through the interstices of the blocks the current and westerly winds bring deposits from the Nile, gradually forming a bank between the inside of the western pier and the channel. Off this pier a bank is making extending over 100 feet to the northeast and across the channel, which, however, is kept clear. A good berth should be given to this pier. It is proposed to remedy the bank by extending the pier, from time to time, until it shall be over 4 miles long, at which distance the Nile deposit will have little effect.

The harbor of Port Said is formed by a large artificial basin, subdivided on the western side into four smaller ones, all opening into the main basin. The first basin on the right (entering) is the commercial basin. It was originally 19 feet deep, but we, anchoring at its mouth, found but 15 feet. The decrease in depth is attributed to the large quantity of coal and other débris from the many ships that, since the commencement of the work, have lain here to discharge. The other three basins, viz, those of the Arsenal, of Ismail, and Cherif, I was informed, maintain their original depth of 20 feet to the first and last named, and that of Ismail 26 feet. The Basin Ismail will prove an easily reached and safe anchorage for any large vessel. Coal of an excellent quality can be procured, and any repairs that a steamer might require can be made. There is a rise and fall of tide of 3 feet at spring, less than 18 inches at neap. A slight current sets seaward nearly all the time, except when driven in by westerly gales in winter, at which time the sea breaks entirely over the western pier.

In conversation with M. Le Baron de Latour, inspector-general of the canal, Commander Beardslee learned that all of the bad spots reported previously by Captain Richards, R. N., to the admiralty, had been completed to the regulation depth and width; that the canal had then for its entire length 72 feet of a nearly level floor, with from 24 to 28 feet water; that the dredgers were about to pass through and deepen to a uniform depth of 26 feet throughout; that the gares also were being widened and deepened; and that there was no ground for fear of the canal being interfered with by the drift of sand, the clayey nature of the dredgings, together with the coarse grass springing up, making firm banks in most places high enough to prevent more than the lighter sand being blown over. He found that the town of Ismailia could be approached with 26 to 28 feet of water, and a good anchorage obtained there. "Seven years ago the place was a desert with no human being or shrub; now it is a flourishing town with gardens and groves, with avenues of trees and vines."

At the time of the passage of the Palos the maximum draught of vessels passing was 22 feet, although in some places his soundings gave 30 feet. The ship was under way in the canal seventeen hours. At the curve nearly abreast of Suez, a fresh breeze from the sea blowing across the canal and the action of the tide setting in made the Palos

rub three times against the eastern side. (This curve has been improved since the date of 1870.)

The voyage through the Red Sea was easy and safe for the steamer; the passages wide, and no dangers in the channel. The heat was not excessive; the thermometer, which had stood at 102° at Ismailia in the shade, never going up on this passage above 96°. The air was very debilitating from the hot and dry wind blowing most of the time. There were more hours of wind from the southern quarter than from the northern, the latter bringing hazy and cloudy weather. The Palos did not experience any very strong currents except near the island of Jibbel-Teer, where the current ran south 18 feet. The light on Perim Island, visible from the northward, furnished safe guide through the Strait of Babelmandeb, little more than a mile in width.

Commander Beardslee forwarded to the Bureau of Navigation, in connection with the report from which the preceding notes are taken, a tabulated statement of the soundings taken on the line of the canal, with a profile of the section taken at the gare of the 24th kilometer; also a tabulated statement of the temperature, winds, and current experienced between the dates of August 15 and 22, the date of his arrival at Aden. The Hydrographic Office "Catalogue of Charts, Plans, &c.," gives the number of his chart of the Suez Canal 254, and of his report No. 257.

The next United States steamer which passed through was the Iroquois, on her way to the Asiatic station. It will be seen from the following brief letter that the facilities of passage had increased since the date of the opening of the canal:

TRANSIT OF THE IROQUOIS, 1872.

U. S. S. IROQUOIS, THIRD RATE,
Gulf of Suez, May 31, 1872.

SIR: I beg to submit the following report of the passage of this ship through the Suez Canal. I arrived at Port Said on the morning of the 25th of May, and could have gone through at once, but the engine requiring some repairs, I was delayed until the morning of the 30th of May. I complied with all the requisitions of the company, having my steam launch towing astern, hawsers ready for use at a moment's notice, and an anchor over the stern, and took other precautions to be ready in case of touching the bottom. We left Port Said at 5 o'clock in the morning and steamed steadily ahead, passing through Great Bitter Lake and Small Bitter Lake, and at 7 p. m. moored to the posts in the gare Guerin. At 5 o'clock this morning cast off and steamed steadily down the canal into the Gulf of Suez, arriving at 9 a. m., our rate of speed being slow on account of a vessel ahead of us. This ship came through the entire length of the canal without once touching the bottom or sides. My leadsmen in the quarter-boats on each side sounded the whole length of the canal as well as possible with the ship going at such speed as we were making. In no case did they get less than four fathoms. The distance between the leads was 51 feet (of course, the center of the canal was deeper). I was exactly eighteen hours under steam way. The greatest speed allowed by the company is 5½ knots per hour. I therefore used only one boiler coming through. From my own observation and from conversation with reliable persons, I ascertained the following facts: The canal is in perfect order

and has a depth of at least 24 feet (for a width of over 50 feet). But few dredging machines are at work, and they are enough to keep it in order. The canal does not fill up with the sand from the desert. The curves are easily turned, and a ship of 400 feet in length (English steamer Lord Clyde) passed through a few days ago without any detention or accident. Any ordinary steering ship can pass without touching either bank. The canal is being used more frequently than it was last year. The average number of vessels for present year is over one hundred a month. On Sunday, the 26th, nine steaming vessels arrived at Port Said, either from Suez or bound to that port. Vessels should coal at Port Said, where the coal is much cheaper and the facilities for putting aboard are greater than at Suez. I inclose copies of the regulations of the canal company. I telegraphed from Port Said for a pilot for the Red Sea and Gulf of Suez, and was fortunate enough to get one who is highly recommended, and who has had a great deal of experience. He appeared on board as soon as I anchored off Suez, as my delay there was short.

Very respectfully, your obedient servant,

H. A. ADAMS,
Commander.

Hon. GEORGE M. ROBESON,
Secretary of the Navy.

PASSAGE OF THE TENNESSEE, AUGUST 14 AND 15, 1875.

FLAG-SHIP TENNESSEE, SECOND RATE,
Suez, August 15, 1875.

SIR: I have the satisfaction to report the arrival of the Tennessee at this port, at 4 p. m. to-day, having left Port Said yesterday at 5.28 a. m., and anchored in Lake Timsah at 2.45 p. m., off Ismailia. The manager of the company at that place very politely invited us to land, and placed his steam launch at our disposal. Accordingly, accompanied by Captain Low and the officers on my staff, I went on shore, where carriages were in waiting to take us about the town. After passing an hour or two very agreeably, and having been shown the works of the company and other objects of interest, we returned on board with very pleasant impressions of our brief visit.

Got under way this a. m. from Lake Timsah at 6 o'clock, and completed the passage of the canal, as above stated, with ease and without accident or obstruction.

No preparation was needed for this interesting navigation other than to hang an anchor over the stern and to have lines in readiness, forward and aft. The ship had her bunkers full of coal, and her draught of water was 20 feet 6 inches forward, 22 feet 3 inches aft.

A speed of from 4 to 5 knots was maintained while in the canal, and the ship's usual speed while passing through the Bitter Lake. Twenty-five tons of coal were expended from the anchorage at Port Said to that at Suez. The ship was under way nineteen hours and seventeen minutes, including stoppages in the "gares" The only approach to an accident occurred from the bad steerage of an English merchant steamer, which slightly fouled our quarter-boats as she passed us in a "gare," we being secured by hawsers to the banks. We had, but a moment previously, passed clear of a large Peninsular and Oriental Company's steamer, she being fast in the "gare" and we going ahead.

This ship, having a balance rudder, minds her helm very quickly; and, under the charge of one of the pilots of the Canal Company, who conned her from the bridge, threaded the narrow channels of the canal without the least difficulty, and without once touching the banks.

The officials of the Suez Canal Company have been exceedingly kind at Port Said, Ismailia, and here at Suez. At each of those places the principal managers called upon me, and, in the most obliging way, placed their services at my disposition, with the offer of every facility in the power of the company to aid the ship in her passage through the canal. They were also so considerate as to send on board Mon-

sieur Lenoir, of the company's service, to accompany us to Suez, whose knowledge of the history of the canal from its conception to the present time, enabled him to give us a very interesting account of the incidents connected with its construction, and of the progress of its navigation, from its opening to the present time. I am informed that M. de Lesseps had given particular instructions in this respect.

I have requested Mr. Beardsley, consul-general of the United States in Egypt, to make my acknowledgment to the superior director of the Canal Company for these kind attentions; and I took occasion to express them, personally, to the gentlemen who did me the favor of calling on board.

Enjoying greatly every mile of the way, and meeting with no embarrassments to mar our progress, I believe I may safely say that we felt some natural regret at completing so soon our passage, in an ocean steam ship-of-war, over the Isthmus of Suez; certainly, there is no navigation in the world which can approach its utter novelty, and surrounded as it is by venerable remains of the most profound antiquity, and in the midst of historical associations of surpassing interest, I cannot conceive of higher, or stronger, or stranger feelings to come over a seaman's mind, than those that must crowd upon him as he conducts his deep keel across the land of the Pharaohs.

I inclose herewith a copy of the "ship's log," and "steam-log" of this ship during our passage from Port Said to Suez, marked Nos. 1 and 2.

I am, very respectfully, your obedient servant,

WM. REYNOLDS,
Rear-Admiral, appointed to command the U. S. Naval Force on the Asiatic Station.

Hon. GEORGE M. ROBESON,
Secretary of the Navy, Washington.

Copy of remarks in log-book of the U. S. Flag-ship Tennessee, second rate, 23 guns, under the command of Capt. W. W. Low, U. S. Navy, in Port Said and passing through Suez Canal, and at anchor off Ismailia, Saturday, August 14, 1875.

Commencing and until 4 a. m. Weather clear, warm, and pleasant; light breeze from northward and westward; bright moonlight. Meteors seen during watch. About 2.30 moon set.—E. W. REMEY, *Lieutenant, U. S. N.*

Four to 8 a. m. Clear, warm, and pleasant; light breeze from northward and westward; starlight first hour. Pilot came on board at 4.30. At 4.40 called all hands unmoor ship; unmoored and hove up starboard anchor. At 5.25 left Port Said and steamed into Suez Canal in charge of pilot. At 5.42 making an average of 5.3 knots. Rev. 25. Ship steering easily and readily. Twenty-three men from shore employed in fire-room to assist our men. Draft of ship forward 20 feet 6 inches; aft 22 feet 3 inches.—F. HANFORD, *Lieutenant, U. S. N.*

Eight a. m. to meridian. Weather clear and pleasant; warm, with light breeze from northward and westward. In charge of pilot. At 10 a. m. were obliged to make fast by taking hawsers from port bow and quarter to shore, in order to allow steamer Carthage, of Glasgow, to pass. At 11 cast off again, got hawser from starboard bow to haul off by. Omitted morning quarters. Rev. 22. Steam, 45. Fire-room, 135.—H. G. O. COLBY, *Lieutenant, U. S. N.*

Meridian to 4 p. m. Weather warm and pleasant. At 12.45 steamer passed by to starboard. At 2,30 called all hands to bring ship to anchor. 2.45 came to with starboard anchor in 4¼ fathoms water, sandy bottom, veering to 22 fathoms at water's edge. Banked fires.—E. W. REMEY, *Lieutenant, U. S. N.*

Four to 6 p. m. Clear and hot; gentle breeze from northward. Fires banked. Distilling. At anchor off Ismailia. The United States vice-consul visited the ship. * * *

At anchor off Suez, and passing through the canal, Sunday, August 15, 1875. Commences and till 4 a. m., clear, warm and pleasant; light breeze from northward. Moonlight. Fires banked. Distilling.—F. HANFORD, *Lieutenant, U. S. N.*

Four to 8 a. m. At 5.30 called all hands up anchor, and at 6 got under way in charge

of pilot. At 5 pilot came on board. At 6 a. m. steam launch with M. Le Nois came alongside. Entered the canal about 6.20. During latter part of watch steaming through the canal in charge of pilot. Weather clear and pleasant. No. rev. 22.5. Steam, 50. Fire-room, 130. Bunkers, 110.—H. G. O. COLBY, *Lieutenant, U. S. N.*

Eight a. m. to meridian. Weather clear, pleasant, and warm; light variable breeze. At 8.07 started ahead full speed to cross Bitter Lake. At 8.25 passed English steamer, of Newcastle. At 10.30 tied up by taking a hawser from starboard bow and quarter, in order to allow English steamer Duke of Sutherland to pass. Under steam alone in charge of pilot. Fire-room, 140°. Bunkers, 130.—E. W. REMEY, *Lieutenant, U. S. N.*

Meridian to 4 p. m. At 12.40 passed English Peninsular & Oriental steamer Deccan, which was in gare waiting for us, Immediately after, we hauled into west bank of gare to let English steamer Orion pass. At 1.25 stood on again through Suez Canal in charge of pilot, Aristee Papan. Steam alone. At 2.30 passed Suez, and at 3.30 came to anchor in 5 fathoms water off Suez, letting go starboard anchor under foot. At 3.40 hove up anchor, shifted anchorage, letting go starboard anchor at 3.55 in 4.4 fathoms water, veering to 30 fathoms, chain. Let steam run down preparatory to hauling fires. Made preparations for getting out steam launch. Clear and hot weather with light to gentle breeze from northward. Bearing at anchorage, ship's head N. by W., SE. corner of Fort Ibrahim NE. by E., Newport Rock light-ship S.¼ W.—F. HANFORD, *Lieutenant, U. S. N.*

Four to 6 p. m. Weather clear and pleasant to fresh breeze from northward. At 4.15 got out steam launch. Rigged lower booms and made other preparations for port. At 4.30 the canal pilot left the ship. By order of commanding officer, loaned one of the boat's flags to a citizen on shore, which is to be returned. Hauled the fires from boilers 1, 2, 3, 4, 5, 6.—H. G. O. COLBY, *Lieutenant, U. S. N.*

Six to 8 p. m. Clear and pleasant; strong breeze to northward. Bright moonlight. W. REMEY, *Lieutenant, U. S. N.*

Eight to midnight. Clear, warm, and pleasant with light breeze from northward. Starlight and bright moonlight. Distilling.—F. HANFORD, *Lieutenant U. S. N.*

The following is the report of Lieut. Com'r C. F. Goodrich, navigating officer, forwarded with the letter of Admiral Reynolds, and filed in the Hydrographic Office of the Navy Departmet.

COPY FROM NAVIGATOR'S REMARK BOOK, U. S. S. TENNESSEE.

THE SUEZ CANAL.

SUEZ, *August* 19, 1875.

Under this head is put all the information collected that may be of service or of professional interest to those about to pass through the canal for the first time.

On approaching we made Port Said light-house bearing southeast by south (p. c.). We kept it a little on the starboard bow until the light-vessel was made off the end of the western breakwater. We then headed directly for the latter and hoisted the jack. A steam tug brought one of the Canal Company's pilots. He boarded us about a mile from the entrance. Under his charge we steamed between the break waters into the commercial basin, let go the starboard bower in about 23 feet of water abreast the arsenal quays, ran a stern line from the port quarter to a buoy on the eastern edge of the channel and another from the starboard quarter to a mooring post ashore. These stern lines formed a cross. The ship was thus secured with her head pointed fair for entering the canal. Here we took in coal of excellent quality and at prices lower than those of Suez. But fresh provisions were neither cheap nor varied.

The preparations ordered by the Canal Company's circular are mostly superfluous. We had ready two hawsers forward, one 6 inch and one 8 inch, and the same aft. The anchor hung over the stern was not used, and is now no longer required, for there are land anchors or moving bollards, ten to the mile in the straight

parts of the canal, and at shorter intervals in the curves. The davits were not swung in.

Through bad steering a passing steamer scraped our quarter-boats while "gared," but without damaging them. I think it would be well to swing in those on the lee side, although in ninety-nine cases out of the hundred entirely unnecessary. The yards were simply braced up sharp by the lee braces, not cock-billed, as the circular directs. The top-gallant masts were kept fidded, the light yards on deck.

As to steering apparatus, the only precaution taken was to see that the wheel-ropes were very taut, that the ship might answer her helm instantly.

The "gares" are the turnouts in this single-track road. Here the floor of the canal is widened to three times its usual size so that a ship may haul out of the way on either side, or if necessary two may haul out at the same time, thus clearing the way for the remaining vessel. At the "gares" or sidings, the company had a boat in readiness to run our bow-line, the stern line we ran ourselves, hoisting the cutter again after casting off. The garing takes place habitually on the weather side, for convenience of shipping. The pilot has absolute charge of the ship from her departure from one end to her arrival at the other.

The Tennessee averaged 5.3 knots through the canal (the maximum speed permitted), stopped three times to "gare," spent one night in Lake Timsah, and was sixteen and a half hours actually in motion.

Starting from Port Said at 5.25 a. m., August 14, she came to in 4½ fathoms in Lake Timsah at 2.45 p. m. On August 15, she got under way at 6.20 a. m. and anchored in the Bay of Suez at 3.30 p. m. It may be well to mention that each ship has her own "canal speed," fast enough to make her steer well, but not so fast as to wash the banks, a speed depending upon the lines of the ship and her displacement. The pilot soon ascertains this rate and adheres to it strictly. The pilot was mounted on gratings across the bridge rail. He gave his orders to the man at the wheel by motions of the hand.

The ship steered admirably, and while under way never touched the ground. Some steamers find it necessary to increase the surface of the rudder by attaching a stiff plate of iron to the after edge. The floor of the canal is 72 feet wide throughout, except at the sidings or "gares," where it is three times as wide, as before remarked. The width at the surface varies greatly, depending upon the nature of the soil. I am confident that theoretical sections are not approached, the sides having gradually assumed their natural slope. Generally speaking the width is 328 feet from Port Said to just north of the Ballah Lakes, and 90 feet thence to Suez. The minimum depth is 26 feet. To assist the pilot in keeping the ship in deep water the mid channel is buoyed in the wide part of the canal by small spar buoys, ten each side to the mile.

The operating the canal, its "running," so to speak, is carried on by telegraph. There are thirteen stations along the line. At each of these there is an agent who has before him a wooden model of the canal with holes in it and pegs to fit the holes. When a ship enters the canal a peg is named after her. This peg is always on the model at a point corresponding to the ship's position in the canal, so that the agents always know the exact state of affairs from Port Said to Suez, each ship's passing a station being telegraphed to every other. In the Great Bitter Lake, for a distance of about 8 miles, there is a clear way, with not less than 28 feet of water. Steamers are permitted to cross this part at full speed. The completeness of all the details of this work is well shown in the marking out of the channel in the Little Bitter Lake. To relieve the strain upon the pilot's eyes of looking for small spar buoys, there are, in addition, outside these, tall iron cage beacons the whole length of the lake.

The expense of going through is divided into two items, tolls and pilotage. The rates of the former are 10 francs for each ton of *gross tonnage*, English measurement. If a vessel have no certificate of measurement, or if her certificate be incomplete or unsatisfactory, she is measured by the company's agents. Ten francs must also be paid for each passenger.

The pilot's dues are as follows:

Draught of ship and toll per decimeter, or 4 inches.

	Francs.
Under 3 meters, or 9 feet 10 inches	5
Between 3 meters and 4.5 meters, or 14 feet 9 inches	10
Between 4.5 meters and 6 meters, or 19 feet 8 inches	15
Over 6 meters, or 19 feet 8 inches	20

Sailing ships having, of course, to be towed, can have tugs at the rate of 1,200 francs for every twelve hours for large tugs and 800 francs for small ones. They may, however, provide their own tugs. In this case they pay 50 centimes (half a franc) extra per ton as towage dues. The item "pilotage" includes bringing the ship into Port Said and to anchor in Suez Bay.

The specific gravity of the water varies greatly. It is 1.05 in Lake Timsah, 1.06 in the Bitter Lakes, that of the Red Sea being 1.03, and of the Mediterranean 1.025.

Besides the local tides at the ends, amounting at times to 2 knots an hour at Suez, there is a slight annual tide from north to south in summer and from south to north in winter, due to the prevailing winds at those seasons. Eventually it must equalize the specific gravities of the water in different parts.

Although warm the heat was not oppressive, for it was tempered by a pleasant breeze from the northward and westward. The highest reading of the thermometer was 89° Fahr., that of the adjacent wet-bulb thermometer being 80° at the same time. This difference indicates that the evaporation was rapid and the heat not insufferable.

The construction of the canal has rendered the climate more humid. Rain occasionally falls, and a sparse vegetation has sprung up along the banks in striking contrast with the expanse of desert on either side. The Canal Company hope that in the course of time the sides may become riveted, as it were, with reeds and grasses, a money-saving protection against washing and cutting.

Our pilot was Aristide Pappa, a Greek, an excellent and capable man. Under his charge the Tennessee came through in shorter time than had ever before been made by so large a vessel. The commerce of the canal amounts to more than one thousand vessels a year. The company can declare a dividend on its stock of 5 per cent. over and above all its expenses when the receipts are 30,000,000 francs. This happened in the last year, 1875. During the first six months of the current year the income was 16,000,000 francs. In 1870 the total receipts were only 5,000,000 francs. The gain is due more to the increased size of the steamers passing through than to their increased number. The total cost of the canal may be put at 470,000,000 francs. One line of steamers only, the Peninsular and Oriental Steamship Company, pays one-tenth of the whole income, their tolls amounting to 3,000,000 francs annually. In conclusion I would say that there appears to me no difficulty whatever in going through if drawing under 23 feet of water, provided the ship steers well. Quick, attentive helmsmen then solve the problem.

The draft of the Tennessee was 20 feet 6 inches forward and 22 feet 3 inches aft. Her length over all is 365 feet and her beam 46 feet.

C. F. GOODRICH, *U. S. N.*,
Lieutenant Commander.

The U. S. S. Alert, Commander J. D. Marvin, was the next United States ship passing through, July 23, 24, 1876. The report of the commander here follows, with abstracts of the returns made to him by his officers:

REPORT OF THE PASSAGE OF U. S. S. ALERT, 1876.

NOTES ON THE SUEZ CANAL, BY COMMANDER, J. D. MARVIN, U. S. N.

The approaches.—The entrance to the canal at Port Said is one of the grandest features of the whole enterprise. It is formed by two jetties, the western running by

compass NE. ¼ E., being 2 miles long, the eastern following a N. by E. ¼ E. course, being 1 mile in length.

They are similar in construction, being made from the foundation up parallelopipedons of Béton Coignet of 10 tons weight, each thrown in at random to form a bed, and, from the surface of the water up, laid with as much regularity as the unevenness of the foundation will permit.

Between these jetties, and following the general direction of the western wall, is the channel, through which 26 feet can be carried. But to insure this depth constant dredging is required all the way from the light-house out. The current sets continually from the west and is obstructed by the jetty. As a result, the sediment, to a large extent due to the wash from the Nile, is partially arrested and partially filtrated through the jetty. Traces of the arrested matter are shown by the extension seaward of beach sands all the way from Damietta, at which point it is barely perceptible, while at the jetty it has formed seaward nearly one-half a mile since the canal was opened.

The sand on which the jetties rest is yielding, and from the size and shape of the blocks used the spaces between are necessarily large. In consequence, the water, charged with sand, constantly washes through and deposits its sediment in the dead water inside. It seems likely that the more compact foundation which might have been formed by using smaller blocks would have to some extent reduced this action. The construction of the entrance at Suez required but little expenditure, and the outlay to keep it in condition is small. A single breakwater from the Arabian side causes the current of both flood and ebb tide to follow the course of the dredged channel, and this of itself prevents the formation of shoals. As a matter of fact the canal is constantly deepening at this terminus.

ROUTINE OF PASSING THROUGH THE CANAL.

A vessel on reaching the port of entry must anchor and arrange for passing. It is customary for commanding officers of men-of-war to visit the directors and ask permission. The ship is gauged, a pilot ordered, and the bill made out in advance. As lay days are charged at Port Said, the time of departure has to be stated to the treasurer before the bill is closed. A copy of the regulations and of signals used at stations is supplied to each vessel.

THE COUNTRY THROUGH WHICH THE CANAL PASSES.

The general course of the canal is south through a continuous sandy desert. The first 20 miles runs through the bed of a former lake, the banks of the canal being only a few feet high; thence to Lake Timsah they are higher, sometimes reaching 100 feet. Lake Timsah, once a dry basin, is now a sheet of water 2 miles long by 2½ miles wide, having through it a navigable channel and an artificial basin three-fifths of a mile square. The town of Ismailia is situated on it; it is almost exclusively a European village, having had no existence before the canal. A fresh-water canal from the Nile gives an ample supply of water, and a considerable vegetation in and about the town. Various species of palms and all varieties of the acacia are luxuriant.

VEGETATION.

Slight traces of vegetation are to be seen along the banks; patches of bulrush and a kind of water juniper, both of which have been tried as a preventive of wash, but with little success, as growth is irregular and uncertain, the absence of fresh water being the great obstacle. The desert sand seems to possess the necessary elements of fertility where water can be obtained. At the signal stations, where it is had through pipes from Ismailia and through ditches or canals leading to the Nile, considerable verdure is seen. The Lombardy poplar, oleanders, white and red, and frequently bamboo, are noticed, all thriving well. The shores of the Bitter Lakes and the banks thence to Suez are perfectly sterile and barren.

WINDS AND RAIN.

The winds are variable at all seasons with a tendency to blow on the lakes in the afternoons of the summer months, from the northward to the westward; desert whirlwinds are continually to be seen on either hand, but it is asserted they never *cross* the canal. It is possible that the immediate local humidity may account for this phenomenon if it exists.

It is asserted that before the canal was opened it never rained along its route, but that now during the winter months rain spits are not unfrequent. During the years 1875–'76 two showers have been experienced, aggregating a moderate rainfall of two and a half hours. This is the greatest yet felt. From the amount of damage done it is estimated that a continuous rain of twenty-four hours would close those parts of the canal where the banks are high.

STRATIFICATION OF THE BANKS.

The long stretch from Lake Menzaleh shows alternate deposits of sand with marine fossils and salt incrustations, indicating successive changes of level and subsidence of the water. When the rains have exposed the strata in the cuttings the undulations are clearly marked, showing that the desert hillocks are the result of upheavals and not entirely of sand-drift due to the winds. Between Little Bitter Lake and Suez occasional laminæ of iron shale were noticed and volcanic scoria exposed at intervals.

PILOTS AND PILOTAGE AND HANDLING SHIP IN THE CANAL.

At Port Said pilots to take ships in are required, and are always to be had off the breakwater. For men-of-war, the plan for anchoring is to drop a bower anchor abreast the custom-house, where the canal is 500 feet wide, in such a position as to be able to veer about 20 fathoms chain, and then run stern lines to the bank opposite the town to hold the ship clear of the channel way.

Mail packets use buoys with hawsers from bow and stern, and remain pointed fair for going out or in as the case may be. Besides the harbor pilots at Port Said, the company has in its employ twenty-four canal pilots, four of whom are "all the way pilots." It is desirable to obtain one of these always; else, a change is made at Ismailia, and the trouble, &c., of breaking in a new hand twice has to be gone through with.

LIGHTS.

The electric light at Port Said, a three-second flash light, visible 22 miles, is on the top of a molded concrete tower 175 feet high, the lantern being reached by a stairway of 350 steps. The machines used are of the pattern known as the "Campagnie d'Alliance," each fitted with 32 magnets and 16 coils. Each has its own boiler and driving engine of six-horse power, and when in use the con is propelled at 640 revolutions per minute. The entire generating apparatus is in duplicate, so that in the event of one being deranged the other can at once be turned on. A simple two-way switch throws the current from either machine to the wire leading to the lantern at will.

The lantern itself is a d. o. lens surrounded by a twenty-sided revolving shade, each of the twenty faces consisting of a rectangular prism, the one slightly separated from the other, thus leaving a series of vertical slits. The effect of flash is developed whenever the ray passes through a prism perpendicularly and in line with the eye of the observer. The rotation is controlled by a centrifugal governor and made uniform irrespective of the working of the engine at the foot of the tower. The light is produced by carbon points, held habitually at about 0.3 inch apart. The feed is not automatic; the upper point is clamped in a holder, which is a simple laboratory stand, the lower point being seated in a socket resting on a spiral spring which admits of considerable distension; both points have lateral motion, enabling the attendant to adjust them so as to make them burn away "square." A pole chamber

permits combustion to be equalized. The fitting for points is in duplicate, one being slid forward into the focus of the lens, the other in readiness to be substituted at an instant's notice. Two attendants are always on duty in the lantern at night. It will be observed that the whole arrangement is of a now obsolete pattern; as compared with the Gramme machine and the "automatic light" it is crude. As it is not at present contemplated that vessels will run in the canal at night, no system of lighting has as yet been provided. There are, however, two light-houses in Great Bitter Lake, one at each entrance of the canal to this sheet of water, but they are not used. The light ship at Suez is the only guide for anchoring at night.

BUOYS.

Except at points where the canal is run through deep cuttings with perpendicular walls, the deep channel is marked by buoys or beacons, five to a mile on either side, "breaking points" so as to give ten to a mile in the aggregate.

The beacons in the lakes are disks or iron tripods, and the buoys heavy wooden cylinders hooped with stout iron. In the canal proper the buoys are spars with an enlarged built-up central section, held in place by a mushroom and section of chain, at the angle between the side wall and bottom of the deep water bed. Distant posts, marked in English nautical miles and tenths of miles, are set up on the eastern bank, and pilots are required to mark the time of passing each, and thus insure the established rate of speed not being exceeded.

STEERING.

Two causes of bad steering are to be apprehended, one the effect of the ebb current in the southern section, which begins to be felt at Chalouf, 12 miles from Suez. It increases in force rapidly from the initial point and reaches 3 knots before arriving at Suez. Badly steering vessels should never run *with* this current. The other imminent source of grounding is due to unequal width of the deep-water section, which is particularly noticeable at the sidings. So long as the channel is of uniform width, a vessel steers steadily and without the use of the rudder; if the course be straight, will follow mid-channel, for the reason that the reflex pressure from the banks is equal on both sides, but where the width is increased by an enlargement wholly to one side, the pressure varies, being, if the width be doubled, four times as great on the side of least extent of deep water as on the other. In consequence the ship yields bodily to the greater pressure and heads directly for the transverse bank which makes the end of the siding.

CURVES.

The curves, with the exception of an S just north of Lake Timsah, are none of them sharp or difficult. The Khedive's yacht, a side-wheel vessel 400 feet long, 45 feet beam, and 65 feet over paddle-boxes, has passed through the canal several times. This of itself is the best proof of its navigability for anything afloat drawing less than 24 feet.

SIDINGS.

There is hardly any part of the canal in which spaces over a mile in extent occur without piles or bollards for tying up to in case of accident, but the sidings or turnouts are specially fitted with conveniences of this kind. When a vessel has to turn out four lines are used, stern, bow, and two breast. A boat from the station runs the bow-line, the ship providing a boat to run the others. As vessels pass it is necessary to check the stern-line, as the reaction of the suction or indraught causes a heavy surge liable to part any ordinary line. The sidings or turn outs are six in number, all on the starboard-hand in passing to s'd, except at Kantara. They have a total capacity in length of 1¼ miles.

The superficial breadth of the canal, a distance from Port Said to the anchorage at

Suez of 87 (nautical) miles, varies from 90 to 200 feet, dependent on the character of the cross-section as controlled by the height of the banks. The width of the deep-water channel is nearly doubled at the sidings. A little out of mid-channel 3½ fathoms were found, but the depth may be called 26 feet good, 4½ fathoms being found as a rule. The capacity of the canal for accommodating a large number of vessels at one time is far beyond the present tax upon it.

The chief outlay in keeping the canal in a serviceable condition is at Port Said, where one or more dredgers are constantly at work inside the breakwater. The dredgers used there along the line where the banks are high have a series of buckets on an endless band, discharging the matter raised into steam valvular-bottomed dump boats. Where the banks are low each dredger carries inside an elevated floating *chute*, through which the sand and water raised are carried beyond the immediate bank or dike.

The effect of wash caused by the passage of large vessels is not great; smaller ones like the Alert do no damage. The banks of a considerable portion are already laid from "wash to suction" with a lava rubble, which is had in quantities near Lake Timsah. In time the whole course will doubtless be so protected. The average work of the canal for 1876 has been so far eighty steamers per month.

Within the report of Commander Marvin, which has now been given mostly in his own words, he furnished a record of the density of the water as taken on the passage from Lake Timsah to Suez. The table shows that on nearing the lake the density commences to increase, and thence to Suez is extremely high. As a measure of the sensible effect of this rise, he notes that while the density at Port Said was normal, the draught of the Alert there had been 12 feet 3 inches forward, 13 feet 9 inches aft, but in the Great Bitter Lake it was but 11 feet 11 inches forward, 13 feet 9 inches aft.

As regards the influence on speed from light-house to light-house in Great Bitter Lake, the distance, 8 miles, was made in 56 minutes; in average sea water the time would have been 1 hour 2 minutes.

The corrosive effect on iron is so active that as far as possible wood is used for buoys and beacons, the iron being rapidly destroyed unless protected by paint, which must be renewed bimonthly.

A species of barnacle attaches to all submerged surfaces, and a shell-fish of the snail variety called corkle is found at many points. The water abounds in young fish, the canal being apparently a spawning and hatching ground.

REPORTS OF THE OFFICERS OF THE ALERT TO THE COMMANDER.

Commander Marvin, when off Port Said had issued an order to the navigator, each of the watch officers, and a medical officer, stating that "the navigation of the Suez Canal being in many of its features wholly exceptional, and in many respects of a character to interest officers of the service generally," he desired to obtain as much descriptive and other data while passing through as it was practicable to gather.

The first-named officers were to submit a general descriptive report containing such information as would seem to them professionally interesting, useful, or instructive. The medical officer would prepare a

report "showing the temperature on deck, in sun and shade, on berth deck and in fire room, each hour, and add such other data as he may deem proper as bearing upon the sanitary condition of ships while passing through."

The reports of these officers, Lieuts. Rich, W. W. Kimball, Norton, and Vreeland, Ensign Halsey and Passed Assistant Surgeon Martin, having been carefully compared, their data have been found to be substantially as follows. They report:

I. *As to the entrance of the canal.*—That approaching Port Said the anchorage outside is good, hard, and generally, but with one stretch of mud, all good holding ground but unprotected except from the southward—anchorage in 5 to 6 fathoms water; and that if one arrives off Port Said at night, the entrance to the port being well defined, he will find this anchorage, Port Said light-house bearing south by compass.

II. *Lights.*—Port Said light on the western breakwater in latitude 31° 15′ 14″ north, longitude 32° 18′ 45″ east, is remarkable for its brilliancy and power—an electric light of the first order. The light-house rises to the height of 175 feet, burning at night a white light, flashing every 3 seconds; by day a red light. The entrance is marked by eight floating lights moored four on a side showing red on the starboard and green on the port hand, entering from the Mediterranean. In rough weather these lights are not always visible, in which case the entrance can be made by bringing Lake Menzaleh fixed white light (which is in line with electric light at Port Said) on a SW. ¼ S. bearing, and steering straight for it. It is preferable, however, to anchor on a hard, sandy bottom one mile from the western end of the breakwater and wait for daylight.

The pilots of the company take entire charge of vessels and moor them in the harbor—war vessels on the Eastern bank out of the way of mail steamers. The company take measurements and receive all charges at Port Said, where a clean bill of health will carry through to Suez. Native firemen for the Red Sea can be generally obtained at three dollars per month, and coal facilities are abundant.

Entering canal it was found impossible to steer compass course, owing to the unequal pressure on the ship from the sides of the canal which was due to the ship not keeping on a center line.

III. *Passage through the canal.*—There is nothing remarkable in the appearance of the canal except the general absence of vegetation; the continued drift of sand necessitates the employment of dredgers throughout. In places where the sand lies at less than the natural angle the banks are supported by imbedded stones. The water pipes from Ismailia to Port Said assist the same object.

Where the channel is regular and the water shoals alike on each side, little helm need be used, but where the bank on one side is much steeper than on the other, the tendency of the vessel is to shoot out toward the deepest water, and the helm must be used freely and quickly. The

services of the pilot are most necessary in the Bitter Lakes; in the Little Bitter Lake and thence southward, close attention must be paid to the direction and force of the wind and to the current, which sometimes sets across the canal.

IV. *Vessels passing each other.*—Ships are not allowed to pass each other except at the stations, the first one arriving at a station tying up. At the longest station or siding, at Kantara, 1,300 feet, three large steamers can tie up at a time.

On the eastern banks of the canal, posts, one-tenth of a mile apart, number successively the distance from Port Said, in miles and tenths of a mile.

V. *Currents and tides.*—Lieutenant Kimball, from whose paper nothing has been taken in the preceding lines, reports, on the authority of the canal company's pilot for the Alert, that between Port Said and Lake Timsah there is no perceptible tide, but little current. The latter depends on the wind, which in the winter sometimes causes a maximum rise of 9 inches of water. Between the Bitter Lakes and Suez, on the ebb, a current sets toward Suez of 2 to 3 knots, running two or three hours after the flood begins to make. It is well to enter the Bitter Lakes in the Suez section at such times as will give the current against the course.

At the stations the ship's stern has a tendency to swing out and sheer her bows into the bank; while another vessel passes "her suck" puts an undue strain on the lines of the vessel which is tied.

METEOROLOGICAL RECORDS.

The observations for temperature were recorded by Passed Assistant Surgeon H. M. Martin. They were taken on the berth-deck, the spar-deck, and in the fire-room on the two days of passage, the 23d and the 24th July. The mean of those taken hourly on the berth-deck, between 10 a. m. and 12 p. m., inclusive, was 85°.7 for the 23d, and of those taken on the 24th between 1 a. m. and 3 p. m., was 84°.6. The maximum observed on the 23d was 90°; the minimum 82°. The maximum on 24th was 87°.

His observations for the same days on the spar-deck, made from 10 a. m. to 7 p. m., were, for the 23d, maximum, in the sun, 98°; minimum, 83°; the mean, 90°.1. Those in the shade read, maximum, 86°; minimum, 79°; the mean of the observations in the shade, 82°.3. For the 24th the maximum in the sun was 109°; the minimum, 85°; the mean, 97°.3. In the shade the maximum was 85°; the minimum, 75°; mean, 78°.7.

For the fire-room on the 23d the maximum was 156°, and on the 24th 170°; the mean on the 23d was 139°.4; on 24th, 146°.

The surgeon stated that no facts of a special sanitary character had presented themselves during the passage of the ship. The desert character of the region traversed by the canal, and the absence of humidity

in its atmosphere, might suggest the facility with which thorough ventilation might be effected at nearly all times without the common risk of malarial influences and damp.

The water obtained at Port Said was quite potable, but at some seasons it contains a good deal of organic matter, care being required to have it thoroughly filtered before it can be considered fit for drinking.

To the meteorological phenomena observed and reported to the commander, the latter added, in his own "notes," the barometrical and other readings of the passage. The range of the barometer was but 0.12 inch, the maximum being 30.02 inches and the minimum 29.90 inches.

I regret to have found on the files of the Department no detailed report from the commander of the Swatara, which passed through the canal at the date of March 16, 1880, nor any from the United States vessels preceding her, back to the date of 1876, or from the ships which have passed since that date. The Ossipee passed in July, 1884.

Commander Sampson, of the Swatara, has kindly furnished a note of special interest:

Vessels passing through the canal are permitted to make 5½ knots only. I was surprised to find how much power it required to drive the ship at this low speed. We were making from 5 to 5½ knots, depending upon the tide, while the power developed by the engines would have been sufficient to drive the ship from 7 to 7½ knots in the open sea.

Looking for the remainder of the work done by the engines, I found it was expended in piling up the water in advance, the ship occupying such a considerable portion of the cross-section of the canal that the body of the water displaced by her advance could not flow freely away. The difference in the level of the water between bow and stern was at times several inches. This influence on speed will depend upon the size (cross-section) of the vessel.

The large English troop-ships are obliged to develop their full power to make 5 knots through the canal.

PASSAGE OF THE ALASKA AND ARIZONA, SIDE-WHEELS.

Two ships of the Pacific Mail Steamship Company, of New York, have made this passage on their route to Singapore and Japan, the Alaska rated on the canal papers as 2,096 tons, and the Arizona 1,664. The log of the Alaska, J. Maury, commander, courteously furnished by the officers of the company, gives the following experience of the ship during the four days of her passage, March 5, 6, 7, and 8. The particulars of this *side-wheel* steamer are of interest as regards her difficulties and her taking the banks of the canal:

Sunday, March 5, 1871.—Fresh northwest winds and passing clouds. At 8 a. m. got under way and steamed for the entrance of the Suez Canal. At 8.30 a. m. entered the canal, steaming along slowly. Ship doing very well. At 2.30 p. m. wind freshened and very squally; had to come to; made fast to the shore. At 4 p. m. started ahead again, wind having moderated. Unable to get a fair start on account of wind and current. At 6 p. m. made fast again, having made one-half a mile. Distance made by observation, 18½ miles. Distance made by wheels, 25 miles; coal consumed, 9 tons.

Monday, March 6, 1871.—Strong northwest to west winds and squally. At 6.10 a. m. started ahead with assistance of one of the Canal Company's tugs. At 8.30 a. m. cast off the tug, she having to coal. Made a trial with the ship alone; was unable to make any headway on account of current and wind; made fast again. Distance made, 6½ miles. At 1 p. m. started ahead with assistance of tug; strong winds and heavy squalls, making very poor headway; wheels taking the banks of the canal several times, making numerous stoppages; distance made, 12 miles. At 5.50 p. m. made fast for the night; distance made by observation, 18½ miles; distance made by wheels, 16 miles; coal consumed, 7 tons.

Tuesday, March 7.—Strong northwest to west winds and passing clouds. At 6.30 a. m. started ahead with assistance of tug. At 9.30 a. m. arrived at Ismailia; Stopped an hour to allow an English screw steamer to pass. Strong winds and squally weather. At 5.25 p. m. wind and current so strong the ship unmanageable in her steering. Made fast for the night; distance made by observation, 40 miles; distance made by wheels, 25 miles; amount of coal consumed, 9 tons.

Wednesday, March 8.—Commences light breezes and passing clouds. At 6.10 a. m. started ahead with assistance of tug. At 9.50 a. m. anchored at Suez.

Dimensions of Alaska were—length 346 feet; breadth, 47 feet; depth, 31 feet; 4,011 tons registered. The reduction of this tonnage by the accountant of the company to 2,096 is to be noted.

The aggregate of canal dues, including those for twenty-three passengers, pilotate, towage, light-house dues, coal, &c., amounted to, 23,178.81 francs, or $4,635.76.

The officers of the Pacific Mail Steamship Company build, as is well known, screw steamers only, and are not likely to send vessels through the Suez Canal in the future, as they find it is to their advantage to send them through the Straits of Magellan, via Panama, to San Francisco.

ANNUAL EXPENSES OF THE CANAL.

[From the report of United States Consul-General Farman for 1878.]

The expenses, aside from interest and other sums applied in payment of debts, are only about 5,000,000 francs per annum, that of cleaning the canal, its basins, and the entrance of Port Said, and of repairs being about $400,000.

This small comparative cost of maintaining the canal arises from the fact that there are *no locks* and no lateral embankments to be broken. If any part of the canal were on a higher level than the sea, so as to require locks, lateral embankments would also be required, which would be liable, as is the case with canals generally, to be broken, and with a canal like that of Suez, which has sufficient depth and width to permit the safe passage of ships drawing 25 feet of water, such breaks would cause great damage. Except the ordinary cleaning of the canal, and the channel at the entrance of Port Said, which is gradually filled by the sediment which comes from the mouths of the Nile and is drifted eastward along the coast, there is little to be done. The canal does not seem liable to the extraordinary expenses to which canals are generally subject.

To this statement are to be added those of the annual reports of the company for the years 1879–'80, which read as follows:

For the year 1879 the expenses of every kind, including the interest of 5 per cent. payable on the original capital stock, were $5,768,360, and for the year 1880 they were $5,611,960.

The total debt of the company was about $23,200,000. This is being reduced at the rate of $500,000 per annum, and the company also appropriates $200,000 a year to permanent improvements, the enlargement of basins, stations, &c.

THE STOCK OF THE COMPANY.

The original stock consists of 400,000 shares of 500 francs each, of which the British Government purchased of the Egyptian Government, in November, 1875, 176,602 shares for £3,972,624, being about 568 francs a share. The interest coupons of these shares up to the year 1894 had been detached in 1869 and surrendered to the company in payment of the last item of 30,000,000 francs above mentioned. As the coupons were taken on the basis of allowing 10 per cent. for the use of the money, it required for the payment of this sum the coupons of twenty-five years, amounting to 110,376,250 francs. The Egyptian Government at the same time surrendered, with these coupons, without any further consideration, its right to the net revenues of the canal that might accrue on these shares during this period of twenty-five years. The net revenues up to 1877 were very small, but if they continue to equal the amount of that year, and they may very much exceed that sum, they will amount on these shares, up to 1894, to about 25,000,000 francs. All that was obtained by this sacrifice of coupons and revenues was of little or no value to Egypt, and they might properly be considered as a gift to the company.

By its contract the Egyptian Government is to pay to England the interest at the rate of 5 per cent. per annum on the purchase-money of its canal shares during the time represented by its detached coupons, that is up to and including the year 1894.

Suez Canal stock has been worth in the market about 150 francs a share more than was paid by England, and, though the English shares are not worth quite as much as the others, because of their present non-participation in the net revenues, yet, as the Egyptian Government pay 5 per cent. on the whole purchase-money instead of on the par value of the shares, this want of participation is partly made good, and England's shares, taken with the contract of the Egyptian Government relating to the payment of interest, may be considered as of nearly the same value as the other shares, so that Lord Beaconsfield's purchase, aside from its political and commercial importance, and the constant receipt of 5 per cent. upon the money invested, has a value to-day of nearly or quite £4,000,000 above what it cost,* and the prospects are

* By the statement presented to Parliament, June 20, 1882, by L. Courtney, of the treasury chambers, Whitehall, it appears that the total amount of cost to the English Government for the purchase of 176,602 shares of the Suez Canal stock from the khedive of Egypt was:

	£	s.	d.
Purchase money of the shares	3,976,582	2	6
Commission thereon of 2½ per cent. paid N. Rothschild & Sons	99,414	11	1
Other expenses incidental to purchase	625	14	10
	4,076,622	8	5

that this value will increase with the continual increase of the business of the canal, and the steady diminution of the company's debts.

The balance of the company's stock is in the hands of a large number of holders, principally in France.

The purchase of these shares is thus noted by Mr. Levy, in his History of British Commerce (1880):

In 1871 it was intimated to the British Government that M. de Lesseps and the company were willing to sell the canal to the maritime powers for £12,000,000, and the payment of the shareholders' dividend; and it was stated that M. Thiers and M. Rémusat had approved of the proposal. It was even suggested that the Italian Government should propose a conference of representatives of the powers to consider the question of the purchase of the canal, and arrange for freeing commerce from the dues by compensating the company. The Porte, however, objected *ab initio* to the formation of an international administration on Ottoman territory, and nothing came from the proposal. More than once, however, Lord Derby stated that his opinion was favorable to a transfer of the property of the canal to an international commission on such terms that all the Governments should have its advantages on condition of equality. But the negotiations upon this particular were quite suspended when Her Majesty's Government were informed in November, 1875, that the khedive, being absolutely in want of £3,000,000 to £4,000,000, was prepared to sell his interest in the Suez Canal to certain French capitalists. Immediately on the receipt of such intelligence Her Majesty's Government telegraphed to Alexandria that they would be ready to purchase the shares on satisfactory terms, and so in a few days an agreement was entered into to the effect that for 100,000,000 francs, or £4,000,000 Her Majesty's Government would purchase the shares belonging to the khedive; that Messrs. Rothschild would pay on the account of the British Government £1,000,000 on December 1, on the landing of the shares, and £3,000,000 in December and January. In due time the shares arrived, the amount was paid, and the British Government became a large holder of shares in the Suez Canal.

The same paper shows that to provide in part for payment of said purchase, exchequer bonds were issued at par, bearing interest at 3½ per cent. per annum, and redeemable at par within thirty-six years, by the application of an annual sum not exceeding £200,000 to the payment of interest and principal, £4,000,000.

INTEREST RECEIVED FROM THE KHEDIVE.

The statement further shows that the amounts received from the khedive to the 31st of March, 1882, "for interest at 5 per cent. per annum on the purchase-money of the shares, in consideration of the deferment of the right to receive dividents," were as follows:

	£	s.	d.
In the year to March 31, 1877	139,110	2	3
In the year to March 31, 1878	198,829	2	0
In the year to March 31, 1879	198,829	2	0
In the year to March 31, 1880	198,829	2	0
In the year to March 31, 1881	198,829	2	0
In the year to March 31, 1882	198,829	2	0

The amount of debt still unredeemed by the sinking fund of the English Governmnt on December 1, 1881, was £3,604,611, 6*s.* 11*d.*

REPORT OF U. S. CONSUL WOLF FOR 1880.

Within his report to the State Department the consul states that the number of vessels which passed through the canal during the year 1880 was 2,017, of which number 1,051 passed from Port Said to the east, and 966 on the return voyage from Suez. Their real gross tonnage was 4,378,964 tons; their official, 2,860,448 tons. Of the whole number 1,579 were under the English flag, 103 French, 69 from Holland, 60 Austro-Hungarian, 52 Italian, 38 German, 35 Spanish, 22 Russian, 11 Turkish. The crews of all the ships numbered 128,453 men, the passengers, 56,862; soldiers, 43,254. In other words, during the year 1880 228,569 persons crossed to Asia by this route, either in the merchant or military service or as passengers.

The postal vessels under the English flag were 183; from France, 56; Austro-Hungarian, 59; Holland, 49; Italy, 46; Spain, 5.

During the decade 1870–'80, 12,454 ships of twenty-six nationalities aggregated a tonnage of 23,105,535 tons. Of these 15 only were from the United States, including the national vessels of which a note has been given.

From the opening of the canal, November 17, 1869, the British flag had furnished 73.12 per cent. of the whole number of ships and 75.48 per cent. of the whole gross tonnage. In this connection it may be stated that the consular reports also showed a subsidy of £100,000 by the British Government immediately on the opening of the Suez Canal to the Peninsular and Oriental Steamship Company to place them in advance of all competition for transporting the mails to Asia and Australia. They also showed that the total revenues of the route for the ten years ending December 31, 1879, had been $40,693,826; those for the year 1880 were $7,862,711. The promise is of a gross annual revenue of more than $12,000,000.

THE EXPENSES OF THE CANAL.

The expenses, including interest on debt, sinking fund, and management of lands have been a little over 17,000,000 francs a year for each of the last five years, so that with the rapid and continued increase of revenues there is no increase of expenses. Over 11,000,000 of these 17,000,000 of francs are expended on account of interest and sinking funds.

The expenses of the various administrations of the company in France and Egypt, including the pay of its officers and its expenses on account of agencies, publications, and the health department, were for the year 1877, 1,135,000 francs; those of the service of transit and navigation, 1,619,869 francs, and those of maintaining, cleaning, and repairing the canal and its accessories, including the annual appropriation for material, 2,283,388 francs.

It will be seen that the total expenses of the Canal Company, aside from interest and other sums applied in payment of its debts, are very small, being only about 5,000,000 francs per annum, while the total revenues for the year 1877 were 33,958,314 francs.

The entire annual expense of cleaning the canal, its basins, and the channel at the entrance of Port Said, and for repairs of the canal and its accessories, is only about 2,000,000 francs.

REPORT OF THE BRITISH DIRECTORS.

[No. 45. Parliamentary Paper, May 25, 1880.]

Sir John Stokes, one of the three directors representing the English Government reported to Earl Granville that he had made an inspection of the Suez Canal, and that its condition as regards depth at its entrances and throughout its course, the maintenance of the works, and the administration of the various services connected with the superintendence of the navigation was very satisfactory, whilst the endeavors made from year to year to improve the conditions under which the navigation is effected could fail to benefit trade. He inclosed the following memorandum:

Port Said.—The condition of the entrance to the canal from the Mediterranean, which, on the occasion of my first visit in January, 1874, was somewhat disquieting, owing to the advance of the shoals reported by me at that time, is now such as to cause no anxiety. The system begun at that time, of employing a powerful steam dredger to excavate during the summer a considerable depression in front of the entrance which receives the Nile deposits driven across this mouth of the canal during the winter, has been found to answer this purpose admirably, and thus an uniform depth of 28 feet is maintained, which is sufficient for the vessels which can pass through the canal, where a vessel must lighten if her draught of water exceeds 24½ feet.

The piers.—The west pier, which protects the entrance from the drift of sand from west to east, is practically the only one that need be considered. The other is of quite secondary importance. This west pier has been well consolidated since my first visit. At that time many of the blocks had subsided, and some had suffered from disintegration. At the present time all signs of these defects have disappeared. The blocks of artificial stone are well above water, and are maintained at an equal height and width.

The port.—The port was very full of vessels, but not inconveniently so. As trade increases it will, however, become necessary to increase the extent of the harbor.

The workshops and storehouses.—I observed in the workshops that a concentration of power had been effected since I was last there, by bringing the work more together and driving more gearing by the same motive power, with manifest economy and advantage to the service.

The work of overhauling and repairing the steam dredgers employed during the summer was being actively carried on. The small factory of the company is so well equipped that the necessary castings can be made on the spot, and the machinery drives the cutting tools requisite for turning out the parts to be replaced; only the heavy castings are obtained from France. Vessels requiring repairs are able to get work done in the company's factory at moderate rates.

The powerful steam cranes of the company are kept at Port Said, where they are constantly required for the works above described. To keep these costly engines at other points of the canal, where they would be but rarely, if ever, required, would be a useless expense, and such as cannot in any fairness be expected of the company.

The course of the canal; the paving of the banks.—The banks of the canal are being gradually paved with stone; 14,700 yards in length on a surface of about 13 feet above and 10 feet below the water-line have been thus made good in the last four years. This work, when finished, will permit of vessels navigating at a greater speed than can be allowed between the unprotected banks. The work of maintaining the normal depth of the canal is unremittingly carried on, each portion of the canal be-

ng periodically dredged; on an average this is necessary once in five years, but different portions of the canal require different treatment; in some, more, in others less frequent dredging is required

Sidings.—Since I last visited the canal, many of the sidings have been both lengthened and widened, adding thereby to the facilities for navigating, and to the security of the vessels obliged to wait in these positions.

Lighters at the stations.—Another new feature which struck me was the presence at each station in the canal of one or more lighters drawn up on the bank ready to be launched in the event of a vessel grounding in the neighboring section and requiring to discharge a part of her cargo to get afloat again. By assembling lighters from the stations in the immediate neighborhood, the officials of the company can speedily have on the spot, if any vessel gets aground, a sufficient number of vessels to receive her cargo. This is a precaution of undoubted benefit to the navigation.

Lake Timsah.—The course of the canal through Lake Timsah has, from the first, presented difficulties; the lines of approach to and departure from this lake form an angle, which it is necessary to replace by a curve. That at first adopted made it difficult for very long vessels to pass in certain winds without taking the ground. In 1877 this curve was, at my instance, made easier by cutting off 90 yards from the point, and thereby decreasing the curve from one of a radius of 320 yards to one of a radius of 820 yards, whilst a large siding was established beyond the curve, making it easier for vessels to round to, to get the new direction of the canal.

As this curve still constitutes a difficulty to very long vessels, the company are going to straighten it still further by taking off another 80 yards from the point, and thus flattening the curve to a radius of 970 yards; * the siding will also be enlarged so that its sides will make an equal curve with the straight line of the canal at either extremity, and thus render the navigation of it easier. I carefully studied this plan for improving the canal in Lake Timsah on the spot with the engineer of the company, and came to the conclusion that it is the best method of improving it. Any further reduction of the curve would create a new difficulty by making too abrupt an angle at the points of junction with the straight portions of the canal, to both of which the new curve is a tangent and an exact quadrant.

Buoys.—The canal is very perfectly buoyed throughout its length, and the deep channel marked at regular intervals by small marionettes. Since my last visit, these latter have been laid down in place of the logs of wood which then served to indicate the channel.

Suez.—At the Suez extremity there has been no change requiring notice, the depth of that entrance being always well maintained without any dredging.

J. STOKES.

CHATHAM, *May* 25, 1880.

DELAYS BY QUARANTINE.

The close of the year 1881 presented a new difficulty in the speedy transit through the canal. According to the Phaire d'Alexandrie of January 21, 1882, arrivals at Suez from India, Batavia, and the coast of Arabia, with even clean bills of health, were subjected to prolonged quarantine, the steamers coming directly from Australia being almost the only ones permitted to pass through the canal. The prevalence of cholera-morbus in the province of Hedjaz, in Arabia, and of this disease or of Asiatic cholera at El Tor and at the Sources de Moise, in Egypt, had caused the quarantine to be established by the "Maritime

* The improvement of this curve has been made during the year 1881, as noted further on.

and Quarantine Sanitary Agency of Egypt." The regulations imposed by this agency appear to have brought about much delay in the transit, and as a consequence, some damages to vessels during the term of several months.

From the published correspondence on this subject, it is evident that the shipping interests of the different ports of England were much excited by these delays to such swift and regular transits as had been secured by the new route. The Chamber of Commerce of Liverpool, the directors of the Peninsular and Oriental Steamship Company, and the shipping merchants of Newcastle appealed not only to the Canal Company, but to the home Government to obtain some alleviation of this rigid quarantine.

M. M. C. H., Aimé de Lesseps, Victor de Lesseps, and the president of the company replied to these appeals that their serious attention had been given to these difficulties, and that, without having considered the company responsible for the extra expenses inflicted by the quarantine, they had made an outlay of 200,000 francs for the establishment at different points of "chalands-lazarets" (barge lazar-houses), in which the canal pilots might remain separated from the shores, and thus after boarding the vessels in transit, communicate no disease on shore. But the sanitary agency insisted that no pilot should board a vessel, and that they would reserve the absolute right either to modify or to abrogate *entirely* and without notice the most favorable regulations which the company could offer. This reservation, the only one of twenty-two quarantine articles which the company could not accept, was not withdrawn by the agency, and the Canal Company continued to find itself unable to control the delays and accidents. These arose from the rigid rule that the pilot, in place of directing the movement of the vessel, skillfully effected by his presence alongside the captain of the ship, was compelled to precede the ship in a small boat, from which he could not possibly give his directions to the ship captain with the necessary quickness or find them carried out as had been before this successfully done.

The canal bulletin of February 21, 1882, announced that the cholera-morbus might be considered as having reached its limit at Hedjaz and at El Wisch; that there was no cholera in Egypt; that neither the employés nor soldiers of the sanitary agency had been attacked; and that there was no reason to believe that any grounds remained for fears of transmitting the cholera into Mediterranean ports. This announcement, quoted from the president of the sanitary agency of Italy in Egypt, was gratifying to shippers as well as to the company of the canal. February 15, 1882, the quarantine was raised, and 25 vessels entered at Suez for free passage.

STORMS AT PORT SAID.

This part of the Egyptian coast is not favored by exception from the storms which are well known to rise suddenly in the Mediterranean.

They have been referred to in the reports of the Canal Company, and in those made to the British Admiralty by officers of their naval service as to their effects on the western jetty, and in the refilling the excavations made in the outer harbor of Port Saïd by the marine dredger.

M. de Lesseps reported, in 1881, that in spite of two heavy storms, one from the 3d to the 6th of September, and the second from the 11th to the 12th of December previous, the harbor had sustained no injury, and the work of their dredger had maintained the equilibrium between the new deposits of sand and their excavations. The bulletins of the company since that date, reported violent storms on the whole coast of Egypt, from the 5th to the 7th of November, 1881, and from the 3d to the 6th of February, 1882. At the first named of these dates a number of sailing vessels of small tonnage, bringing supplies to the port, were rescued from extreme danger, and towed into the harbor by the steam tugs of the company. This storm appears to have been too severe to permit two of the steamers of the "Messagéries Imperiales" to leave the harbor for the Mediterranean. One of the sailers, anchored 5 or 6 miles distant, stood out the storm during the night, the wind having shifted from the west to the southwest. The violent storms of this sea generally take their rise with the northeast or southeast winds prevailing in the autumn and winter.

The latest reports are those of a storm during which no vessel entered the harbor, navigation being almost entirely suspended. Forty ships awaited at Port Said and Suez to enter the canal. The dues of entering vessels amounted to 360,000 francs. No very protracted delays from the causes named appear, however, to be now reported. It is of interest to note the watchfulness of the shipper of our day of the slightest falling behind by his steamer from the very day on which he expects her in port. The telegraph, as is well known, aids him in the sale of merchandise usually far in advance of its arrival.

A TRIP THROUGH THE CANAL.

A correspondent of the London Times, writing in February, 1881, of his return passage through the canal after his outward voyage of seven years previous, stated under date of February 29, 1880, that to the confusion of the prophets the canal maintains its normal depth, a Russian iron-clad, drawing 24½ feet, having passed the day before without any check; that the sand storms and wash which were prophesied as great dangers are easily controlled by the occasional use of three small dredgers which the company keep always on hand, and that the current from the Red Sea, once considered so formidable, have proved no detriment at all. He reports that he found the canal faced with stone for about one-fourth of the route, and that Port Said is the fastest coaling station probably in the world, 7,000 Arabs thriving on the coaling business. He complained of the dull and slow rate of passage permitted of about five knots an hour, and of the want of the improvements which,

he says, were promised years ago; and considered that now that the company are prospering they ought to increase the number of stopping places so that ships could pass anywhere on the route, in other words that the whole route of the canal should be doubled. He seems evidently to have been uninformed of the outlays and progressive improvements even then reported to the British Government by the three English directors now in the council of the company. As to the idea of the entire widening of the canal, his opinion may be placed alongside of that of Admiral Rider, R. N., who reported to the Admiralty in 1874:

At first sight it might appear advisable that the canal should be widened, but I am convinced it would be a misfortune, as wild vessels that now canon harmlessly from bank to bank of the ditch, which is only 72 feet across, would then, instead of canoning, dig their stems in and stick perhaps for hours.

It is also against a report made by Colonel Stokes, one of the three directors, who has said:

It has been urged as a reproach against the company that it did not excavate a channel of the full width originally intended, namely, 200 feet at the surface and 144 feet at the bottom; but I think it is a fortunate circumstance that the intention was not carried out. I believe that the navigation is in consequence effected in much greater security, that the risk of collision is greatly reduced, and that in the long run the passage through the canal is performed in a much shorter average time than if vessels were allowed to navigate without supervision in a channel of the width originally proposed, a freedom for which those contend who find fault with the present width of the canal.

From the uncertainty of the currents and other causes affecting a vessel steering, it does not unfrequently happen that she takes the ground, but as the channel is narrow, when she swing across it on grounding she is inclined to the direction of the canal at a very small angle, and it is therefore easy to haul her off and get her straight.

The only delays to which a vessel can be subject are those which arise from her finding one or more vessels in the section ahead of here, and whose passage she must wait. As the sidings are for the greater part of the length of the canal not more than five or six miles apart, these delays as a rule are not long.

If the orders of the superintendent are obeyed the blocking of the channel from a collision is rendered almost impossible.

[The telegrams in the London Times noting the short delays of passing ships and the reports of the United States vessels to the Navy Department confirm this statement.]

Colonel Stokes further says:

If the canal were wider and vessels allowed to navigate without restriction, obeying only the rule of the sea, the usual rivalry and endeavor to get through as quick as possible would, even if restrained by regulations, be accompanied by the usual collisions, sometimes occurring from accidents beyond control; even if no collision should occur the effect of a vessel touching the ground would in a wider channel be much more serious than at present; the average passage would be longer from delays and accidents, and there would be the ever-present danger of the channel being closed.

There is practically no limit to the number of vessels that can be passed; the present "sidings" can be increased in number, but as the large Bitter Lake affords the means of shunting any number of vessels it is unnecessary to widen the canal. The fact that Her Majesty's troop ships, vessels of 4,400 tons, 400 feet long, of 52 feet beam, and drawing 22 feet of water, pass through the canal in an average on forty-nine voyages of seventeen hours under weigh, their average time in the canal being

about forty hours, affords a convincing proof of the sufficiency of the canal for all reasonable purposes and as a mercantile highway. These ships, from their great height out of water present unusual difficulties, as the large surface exposed to the action of the wind must cause them to make leeway under a cross-wind more than vessels having less free-board. It is to be remarked that these vessels are perfect in their capacity for steering and are handled in a most masterly manner; but beyond these advantages, attainable by every vessel, they enjoy no special privilege in the navigation of the canal and have to take their turn in the sidings like others.

The only exception to this rule is a general one in favor of postal steamers, which alone are allowed to go through during the night, and for which all other vessels have to give way.

The recent decision of the International Commission has been already noted in favor of doubling the width of the present route. The details of this have not as yet, August 8, 1884, reached the United States. In the discussion of the plans for it at the joint meeting of the English directors and the representatives of the company, the principle was admitted that "however much the canal may be widened, the passing of vessels *en route*, whether going in the same direction or meeting one another, should never be permitted, as this freedom of navigation would inevitably lead to collisions most fatal to traffic. The canal cannot be navigated under the conditions of a river. If vessels advance at full speed, as in a river, so as to give them full steering power, the displaced wave would be so great as to destroy very rapidly the canal banks, whilst, if they are propelled only at the reduced speed allowable under the circumstances, their steering is too uncertain to allow of free navigation without danger of collision. The obstruction of the canal from a collision in which a vessel were sunk would be a far more serious matter than from one taking the ground." It was also agreed at this meeting that the system of forming intermediate basins and passing vessels through in trains, twice a day, would involve many difficulties from the different qualities of the ships composing each train, and the necessity of allowing space between every two vessels, in order that the grounding of one may not lead to her being run into by the vessel astern. The working of these vast masses cannot be conducted with the ease and precision by which a train of carriages coupled together and running on rails can be moved.—Parliamentary Paper, Egypt, No. 17, 1883.

CHAPTER IV.

THE SUEZ CANAL IN RELATION TO A CANAL ACROSS THE AMERICAN ISTHMUS.

The experience of the canal instructive for a like work on the American Isthmus.—The latest returns of the transit.—Expansion of commerce, increase of ship-building, and conversion of sailers into the steam marine.—Reports from the United States consuls.—Demands for a second canal.—Negotiations for this and for reduction of tolls.—Proposed neutralization of the route.—Occupation by the English.—Alleged superiority of an American route.—Its construction a much more serious problem.—Summary of the projected routes across the Isthmus.—General conclusions.

For any similar work the history of the Suez route is eminently instructive, even although the physical character of the region for another canal may be exceptionally different. The eastern highway presents the first successful opening of a strait crossing a continent, and saving, by one-half, the distance, time, and dangers of a former route. It has been the first, also, to provide for the demands of commerce in the age at which we have arrived, in which the maximum would seem to have scarcely yet been attained for the dimensions and tonnage of shipping.

The instructive points of the Suez route lie within its conquest of the natural, political, and financial obstacles which have been stated; its commercial and financial success; and its influence in stimulating and modifying the ship-building of the day. In the present state of American shipping the last of these points seems as important as any which could be named.

The success of the route is to be credited to the indomitable energy and perseverance of its able projector, to which qualities he added the strategy of diplomacy, necessary not only as against English but Egyptian and Turkish oppositions and delays.* The masterly handling of the

*A letter to his mother-in-law is here added. As a private family note, it throws light on Lesseps's first ideas and his faith in them:

Le 22 janvier 1855 il écrit à Mme. Delamalle, sa belle-mère: "Je veux faire une grande chose, sans arrière-pensée, sans intérêt personnel *d'argent*. C'est ce qui fait que Dieu m'a permis jusqu'à présent de voir clair et d'éviter les écueils; je serai inébranlable dans cette voie, et comme personne n'est capable de me faire dévier, j'ai la confiance que je conduirai sûrement ma barque jusqu'au port que nous pourrons appeler Saïd, du nom du vice-roi, qui veut dire en arabe *heureux*. Ce qu'il y a d'heureux pour le but que je poursuis, c'est que mes actes et mes démarches ne sont pas, Dieu merci! soumis aux instructions et aux désaveux d'aucun gouvernement. Chat échaudé craint l'eau froide. . . . Mon ambition, je l'avoue, est d'être le seul à conduire tous les fils de cette immense affaire jusqu'au moment où elle pourra librement marcher. En un mot, je désire n'accepter de conditions de personne, mon but est de les imposer toutes. Lorsque, dans ma jeunesse, je résidais comme agent français auprès de Méhemet Ali, ce grand réformateur me dit un jour: 'Rappelez-vous, mon jeune ami, que si dans le cours de votre vie, vous avez quelque chose de très important à faire, c'est sur vous seul qu'il faut compter. Si vous êtes deux, il y en a un de trop.'"—[Quoted by Allouy from "Lettres, Journal et Documents."]

interests of the canal company has been exhibited even at the present stage of the canal history in the preservation of the works during the English occupation, and in the harmonious working with the English directors who share in the council of administration. This last-named point is repeatedly made by the directors themselves in their reports to Parliament.

The commercial and financial success of the canal has been stated in part in the first pages of this paper. It is confirmed by the following later returns drawn from the report of the council to the general assembly of the stockholders, held at Paris May 29, 1884, and by the returns from the United States consuls to the State Department, including those of Consul-General G. P. Pomeroy.

The official reports of the canal to the date of June, 1884, received also since the preceding pages were sent to the press, furnish the following items.

The Bulletin Décadaire, of June 2, presents the following:

I.—THE FINANCIAL SITUATION.

Receipts and expenses for the year 1883.

	Francs.
Gross receipts	68,523,344.73
Expenses of every kind, including the 5 per cent. guaranteed on the social capital	30,772,248.67
Excess of receipts	37,751,096.06
From which deduct the 5 per cent. reserve for pensions, &c	1,887,554.80
Net profits	35,863,541.26
Reserve for improvements (article 64 statutes)	12,676,056.33
Dividend payable July 1, 1884	23,187,484.93

The dividend, according to article 63 (statutes, modified 1871), is apportioned as has been stated: To the stockholders, 71 per cent.; Egyptian Government, 15 per cent.; founders, 10 per cent.; administrators, 2 per cent.; employés, 2 per cent.

The "reserve" of 5 per cent. is now reduced to 3 per cent. in accord with article 62 of the statutes. Its design is for unforeseen expenses, pensions for invalids, &c.

The *increase* of receipts from all sources, transit, sale of lands, machinery, &c., had been 8,723,404.18 francs, or nearly 16 per cent. over the year 1882. The company received considerable returns from their supplies of water, and especially from their investment of redeemed coupons.

The expenses of working the canal, &c., had been 18,267,786.11 francs. Some were exceptional, chiefly the investigations for the new Sweet Water Canal from Ismailia to Port Said, sanitary measures and quarantine delays during the cholera season, and payments of 23,500 francs to the *personnel* of the company, for their increased expenses of living during the recent war. The increased expenses of the year have been chiefly through the hastening of the improvements voted for June 6, 1883.

II.—PRINCIPAL ENLARGEMENTS AND IMPROVEMENTS.

At Port Said the enlargement of the Ismail basin, the straightening of the west bank of the outer port, the construction of a new basin on the African bank, lighting the harbor and port with Pintsch gas, and the further placement of buoys. At Tous-

soum, construction of a new siding; at Kantara, lengthening the siding; in the Bitter Lakes, enlargement of the canal in the small lake; the further doubling of the mooring posts in the sidings and curves; and the extension of the stone facing of the banks. The total expenses of these (previously provided for) amounted to 4,343,440.60 francs.

III.—Renewal of Material.

	Francs.
The funds for this purpose derived from the sale of old material inutilizable, and other sources, amounted to	1,038,370.76
From which was paid for new tugs and other boats	133,849.54
Leaving available for this purpose	904,521.22

Chief machinery purchased.—A third sea-going dredge, 551,500 francs; a tug and a hydraulic engine, 376,000 francs.

IV.—Transit and Navigation.

The "mouvement" was 5,775,861 tons (official net), returning 65,847,812.16 francs, from 3,307 ships; an increase over 1882 of 701,052 tons, 109 ships, and 5,301,930.80 francs. The increased per cent. was 13.81 tonnage, 3.40 for ships and 8.76 for the receipts.

Entretien (Maintenance, Repairs).

The whole line of the canal, its stations, the harbor, and entrance have been kept at the normal depth by the regular working of the dredges, which excavated in 1883:

	Cubic meters.
Outside the jetties	159,962
Channel leading to harbor	184,054
Total	344,016
On the line of the canal:	
Section of Port Said	298,593
Section of Ismailia	165,490
Section of Suez	135,827
Total	*599,910

The Jetties.

The large west jetty of Port Said has been repaired by the addition of eighty-eight blocks in masonry on the crown and sixty on the facings with mortar. The squalls which raged at Port Said in the month of February did not injure the harbor works.

International Commission for Enlarging the Canal or Constructing a Second Canal.

On the 16th June of the present year, this Commission assembled at Paris to examine the different plans for "satisfying completely the progressive movement of navigation between the east and the west." "The Commission consisted of 21 members, of whom 7 were French; 8 English; 2 German; 1 Spanish; 1 engineer from Rome; 1 from Holland (Dirks); 1 (Captain Alexiéff) an attaché of the Russian ambassador at Paris.

During the year 1883 1,663 ships passed from the Mediterranean and 1,644 from the Red Sea; of the whole number 310 passed for the first time, 30 of them National

*Or 781,882 cubic yards.

ships. 96 merchant vessels passed in ballast; 500 ships drew more than 7 meters, 27 drawing 7.49 meters, and 14 ships drawing 7.50 meters.

Of the whole number 2,596 were merchant vessels; 588 postals; 2,537 were under the English flag; 272 French; 124 from Holland; 123 Germany; 67 from Austro-Hungary; 63 from Italy; 57 from Russia.

TIME OF PASSAGE.

The mean time of the direct passings through was 19 hours, 32 minutes. The time of transit was somewhat increased by the presence of cholera, by severe storms in the month of March, and by the increase in the number of vessels passing through. The trade with Australia called for an increase of sixty new ships.

STEAM LINES.

Five new steam lines were organized; 36 old lines increased their fleets by adding 81 ships.

The number of voyagers passing from sea to sea was 115,597. Of this number there were emigrants to Australia, 22,686; English soldiers, 21,056; French soldiers, 14,280; civilian passengers, 36,149; and Mahommedan pilgrims, 6,901. To the whole number as stated above is to be added 3,579 passengers in sailing vessels, making the total 119,176.

The returns furnished in Egypt to Consul-General Pomeroy vary but slightly from the preceding, and contain items of additional interest. Under date of February 18, 1884, after tabling the number of vessels and receipts for the years 1870 to 1883, he adds:

Of the 3,198 vessels having made the transit in 1882, 2,565, of a gross tonnage of 5,800,000 tons, were under the British flag. The remainder, viz, 623 vessels, of 1,325,000 tons, belonged to seventeen different nationalities, of which 165 were French, 109 German, 103 Dutch, 67 Austrian, 61 Italian, 32 Spanish, 20 Norwegian, 21 Egyptian, 18 Russian, 13 Belgian, 10 Ottoman, 4 Chinese, 4 Greek, 2 Danish, 2 Portuguese, 1 Siamese, and 1 from Zanzibar.

The different categories of vessels which have taken part in this movement are composed as follows: 2,361 steamers of commerce, 506 postal, 129 steamers chartered for the British expedition to Egypt, 59 avisos, 42 Government transports, 22 gunboats, 12 corvettes, 10 iron-clads, 10 yachts, 8 cruisers, 2 sail schooners, 1 frigate, and 39 tugboats. * * *

The 3,198 vessels composing the movement via canal in 1882 do not, in reality, taken from a commercial point of view, represent more than 2,867 effective steamers that have passed through with cargoes of different nature.

The traffic under the British flag slightly diminished in 1882, compared with that of 1880 and 1881. Indeed, it had reached 80 per cent. in 1880, whereas in 1881 it had attained the enormous figure of 82½ per cent. The decrease is due to the *augmentation* of French, German, Dutch, and Italian ships and tonnage. Among these, the French flag has exceeded the figure of 5 per cent. on the general movement in 1882, whilst in the year 1881 it had hardly attained 4 per cent.

The very active engagement in affairs and transactions established by the Suez Canal takes progressively immense proportions. The great French, Dutch, German, Italian, and Spanish navigation companies are doubling and tripling their material and will, before long, be able to cause a serious competition to the British flag, not only in China, India, and the Birman Empire, but also in Australia and Japan, without counting the Philippine Islands and the South Archipelago. On the other hand, the sailing vessels still frequenting those parts are greatly diminishing, while the number of steamers continues to increase.

The traffic and receipts of the canal of Suez for the year 1883.

Nationality.	Number of vessels.	Net tonnage.	Gross tonnage.	Receipts.
				Francs.
English	2,537	4,406,088.03	6,134,930.27	49,920,310.03
French	272	557,088.03	782,133.05	6,341,178.84
Dutch	124	229,302.01	309,552.29	2,612,273.91
German	122	156,309.18	231,425.81	1,763,922.57
Italian	63	131,953.69	195,101.64	1,476,963.20
Spanish	51	106,953.04	148,501,91	1,221,221.17
Austrian	67	98,684.23	136,586.35	1,194,518.25
Russian	18	28,069.05	44,294.69	345,669.89
Norwegian	19	25,400.46	34,386.22	291,078.87
Belgian	12	17,244.66	23,450.36	194,182.48
Ottoman	9	6,668.01	9,722.15	106,627.13
Japanese	5	4,204.58	6,172.41	47,822.16
Egyptian	3	3,007.77	4,736.33	37,221.09
Chinese	1	2,299.99	3,097.96	24,286.90
Danish	2	1,881.80	2,741.60	24,099.98
Portuguese	1	880.25	1,333.00	12,287.11
American	1	778.57	1,141.23	3,643.20
Total	3,307	5,778,323.35	8,051,307.29	65,622,306.78

Table of medium effective sailing and total stay in the canal per vessel in 1883.

Months.	Effective sailing.	Total stay.
	h. m.	*h. m.*
January	19 33	59 26
February	19 28	53 37
March	20 37	70 12
April	20 13	54 18
May	19 40	42 18
June	19 33	39 17
July	19 28	39 42
August	19 30	43 33
September	19 6	41 14
October	18 54	43 12
November	18 41	44 27
December	19 11	51 57

The dividend for 1882 was, including the 5 per cent. interest which each share bears, 16 per cent., and for 1883 it has slightly increased, viz, 17.3 per cent.

Owing to a variety of circumstances, the year 1883 did not open well for the canal company's business. In January and February the traffic was less than during the same months of the previous year. In January, 1883, the number of ships was 251, the tonnage 610,769, and the receipts were 4,999,307 francs, as against 305 ships of a tonnage of 639,605, and 5,443,051 francs in January, 1882. In February, 1883, the number of ships was 215, the tonnage 521,440, and the receipts were 4,278,840 francs, as against 290 ships, 613,830 tons, and 5,247,960 francs in February, 1882.

In March, 1883, things took a turn for the better, and the number of ships was 367, the tonnage 851,367, and the receipts were 6,993,596 francs, as compared with 313 ships, 662,494 tons, and 5,645,136 francs in March, 1882.

The total for the first six months showed an increase of 82 ships of a tonnage of 568,458 tons and 3,407,270 francs.

Though in July the increase was maintained, the months of August and September again showed a diminution, the figures being in August 252 ships and 5,180,000 francs, as against 343 ships and 5,610,645 francs in August, 1882; and in September 237 ships and 4,794,502 francs, as against 246 ships and 4,960,000 francs in September, 1882.

In October the traffic again increased and the number of ships was 223, and the receipts 4,656,962 francs, as compared with 208 ships and 4,258,293 francs in October, 1882. In November and December the receipts once more slightly increased, the

totals for the two months being 470 ships and 9,853,000 francs, as against 432 ships and 9,144,557 francs for November and December, 1882.

It therefore results from the foregoing that in no less than four months—namely, January, February, August, and September—there was a positive falling off in the business of the company, and though in the other months there was an increase, the net results for the year tend to show that the canal traffic is reaching the furthest stage of development which it is likely for some time to attain, and this is a fact which those interested in making a rival canal will do well to reflect upon.

It is, of course, impossible to say what the future may have in store, but it is obvious that the business of the canal cannot be reckoned upon to increase in the rapid manner in which it has done in the past few years.

The twelvemonth just elapsed cannot be looked upon as an exclusively bad one for maritime business on the whole, and the returns of the canal traffic for that period may be taken as a fair sample of what the canal will realize for some time to come.

The anticipations of the consul-general expressed in the last of these statements do not seem to have been realized, for on the 31st March, 1884, his returns were as follows:

QUARTERLY REPORT ON THE GENERAL TRAFFIC OF THE SUEZ CANAL, COMMENCING JANUARY 1. ULTIMO, AND ENDED MARCH 31, 1884.

Traffic and receipts.

Flag.	Number of vessels.	Net tonnage.	Gross tonnage.	Receipts.
				Francs.
English	736	1,276,531.910	1,801,444.250	13,836,935.15
French	76	148,180.431	216,775.986	1,669,091.46
Dutch	36	66,278.860	89,803,230	719,680.13
German	36	47,525.210	66.132.880	513,659.79
Italian	15	33,406.620	48,861.120	354,813.11
Austro-Hungarian	18	27,236.470	37,672.850	322,631.57
Spanish	13	26,001.160	36,876.360	284,790.83
Russian	6	5,588	15,445.350	127,904.40
Norwegian	7	9,290.560	12,708.710	101,720.60
Portuguese	2	1,656.310	2,780.290	21,671.80
Belgian	1	1,623.840	2,220.130	17,610.40
American	1	1,625.480	2,390.460	17,564.80
Ottoman	1	439.640	640.810	5,211.90
Egyptian	1	279.170	566.040	3,142.70
Total	949	1,649,663.661	2,334,318.466	17,996,428.64

Of the 949 vessels there were 716 steamers of commerce, 159 postal vessels (13 in ballast), 36 Government transports, 7 gunboats, 4 cruisers, 3 avisos, 2 iron-clads, 4 corvettes, 2 yachts, 1 torpedo-boat, 2 carriers (porteurs).

Of the 949 vessels 556 have entered the canal from the Mediterranean and 393 from the Red Sea.

Of the passengers there were English military, 15,182; French military, 8,460; Turkish military, 3,282; Dutch military, 833; Russian military, 715; Spanish military, 322; Portuguese military, 288; Australian emigrants, 4,739; Siberian colonists, 1,285; Russian convicts, 525; civilian passengers, 8,639. Total, 44,270.

Medium sailing in the canal and medium tonnage per vessel.

Month.	Effective sailing per vessel.	Total stay per vessel.	Net tonnage.	Gross tonnage.
1884.				
January	19h 44m	57h 14m	1,750.960	2,477.365
February	19 40	47 17	1,763.108	2,503.730
March	19 22	45 28	1,702.440	2,407.690

INFLUENCE OF THE CANAL ON SHIP-BUILDING, AND ON THE COMMERCE OF THE EAST.

The opening of the Suez Canal almost immediately showed a marked expansion of trade with India, China, Japan, and Australia; an increase in the aggregate tonnage of the merchant marine; and a rapid advance in the conversion of sailing vessels into steamers. The influence thus exerted is shown by the official statistics chiefly of England, France, Australia, and Germany, the leading commercial papers frequently noting it. A recent number of the Shipping Gazette of England states:

The number of steamers of the English merchant marine has largely increased since the opening of the Suez Canal in 1869, from which date there has been a great falling off in the employment of sailing ships for the trade with India, China, and Australia, since it is no longer necessary to make the long detour round the Cape of Good Hope, merchandise being more rapidly and more conveniently transported by the Suez route. The tendency increases for the enlargement of ships, and this in a proportion more than double the dimensions adopted thirty years ago. The mean tonnage of English steamers engaged in foreign commerce was then 525 tons. In the ten following years it rose to 690; between 1870 and 1880 it increased to 998 tons. This transformation of a large part of the foreign commerce of England to steamers has been so steady that we have now two steamers to one sailer. Sailers passing round the Cape will not be replaced.

In respect of the trade between England and India, Mr. C. R. Markham, in his "report to Parliament (1872–1873), exhibiting the moral and material progress and condition of India," said that the chief interest in the sea-borne traffic of India already lay in the development of the transport of merchandise by the Suez Canal; that out of the total value of the trade of India with Europe and America about 6 per cent. passed through the the canal; the number of steamers arriving at Bombay having been 122 as against 88 in the year 1871; and that a trade has thus sprung up with the countries bordering on the Mediterranean. Austria, Syria, and Sicily appear for the first time on the trade list, with an increase of the trade with Italian ports.

The preceding statements in regard to the construction of ships in England are confirmed by a letter by Mr. Alfred Holt, head of the Ocean Steam Navigation Company, Liverpool, in which he says:

The construction of sailing vessels in this country is almost at a stand-still; there are a few for special trades still under construction, but a clear conviction prevails in all ship-owning circles that the instrument for general sea carriage in the future is the iron screw steamer.

It is supposed that at the present moment more tonnage of this type is being produced in the United Kingdom than at any previous time. The difficulty of getting iron is somewhat delaying delivery, but when that is overcome by time, the increase to the British steam fleet will be something enormous.

INCREASED USE OF STEEL.

The majority of the vessels launched on the Clyde in 1833 were of iron, but every year furnishes evidence of the growing favor in which steel is held as a ship-building material. In 1879 the steel-built vessels had a tonnage of 18,000 tons; in 1880 the aggregate reached 42,000 tons.

in 1881 it rose to 66,609 tons; in 1882, it amounted to 108,254 tons; while in the year 1883 a total of 129,651 tons has been attained.

The following reports of United States consuls to the State Department are in proof:

REPORT BY CONSUL JONES, OF NEWCASTLE.—SHIP-BUILDING IN 1881.

In my last report upon the ship-building of the northeastern district of England I ventured to say that the future of this industry looked bright and promising. But the brightest anticipations and most sanguine forecasts have not only been realized, but greatly exceeded in the measure of growth and prosperity which have attended this trade during 1881; for during no previous year in the history of this country have so many ships been launched from the yards of the United Kingdom. Pessimists have been whispering for years that ship-building was being overdone; that the tonnage afloat already exceeded the legitimate demands of trade, and that both builders and owners must come to grief certainly and soon. These alarmists have ignored the important considerations that the population and commerce of the world are ever increasing, that wooden ships, and even iron sailing vessels, are being displaced by steamers; and that old steamers also are obliged to give way to their more modern competitors with their improved appliances for saving labor and fuel, and, therefore, for lessening the cost of sailing. New steamers frequently make handsome profits where the old ones are ruining their owners. It may with safety be asserted that the tonnage built in the world during 1881 has been greater than that of any year in the past. It is equally true that Great Britain transcends all other nations in this important branch of manufacture, and that her supremacy in this regard grows greater with each succeeding year.

At the end of 1880, British shipping engaged in the home and foreign trade, exclusive of river tonnage, represented 19,972 vessels, with a tonnage of 6,344,577, giving employment to 192,972 seamen. During 1881 no less than 618 vessels, with a tonnage of 889,531 tons, were launched into the British carrying trade from north-country ship-yards alone. It can be satisfactorily established that shipping is the most lucrative of commercial ventures. It is also true that ocean transportation is certainly and rapidly concentrating under the British flag; and no intelligent American can contemplate the situation, and examine the tables which I shall herewith submit without regretting the decadence of our own ship-building and shipping; without heartily wishing that "something might be done" by legislation and private enterprise to revive a most important industry, to multiply the vessels sailing under the American flag. No opinion is here advanced as to the means whereby a revival in shipping and ship-building is to be attained. But one important fact is clear—British ship-owners admit that American masters are equal, if not indeed superior, to any others in enterprise, capacity, and intelligence; and competition with Americans in the carrying trade of the world is the last thing they desire to encounter. I make this statement not as a mere personal opinion, but as the expressed views of competent and experienced judges.

The extraordinary prosperity in ship-building has been enjoyed notwithstanding serious drawbacks and hindrances encountered in 1881. During the first three months of last year, severe frosts and snow-storms prevailed in this district to such an extent as to render all outdoor work in the yards impossible for a considerable time. The loss thus sustained has been estimated at about thirty days. A large firm on the Tyne report that, out of seventy-seven possible working days in January, February, and March, thirty-two days were lost owing to the severity of the weather; and all the builders agree in saying that but for this inclement weather a greater amount of tonnage had been turned out. Moreover, a strike, or rather a complicated squabble, existed on the Wear for about four months—a state of things which greatly reduced

the possible production of that river. But in spite of these drawbacks unexampled prosperity has attended this industry. Wages have been raised throughout the district; all the yards, with the exceptions given, have been working to their full capacity, and orders are "booked" in many if not in all the yards for more work than can be accomplished during 1882.

It is interesting to watch the tendency which indicates the future of ship building. Wooden vessels are being entirely superseded; sailing ships of iron also are losing favor, while steel ships continue to be built, especially on the Tyne, though not in large or increasing numbers. The Clyde turns out a greater number of sailing vessels than any ship building river in the United Kingdom. Fifty-two vessels of this character were launched last year against 217 steamers. My figures do not show whether any steel ships were built on the Clyde during 1881 or not. The Wear turned out four iron sailing vessels, representing 5,021 tons burden; the Tees four sailing-vessels, of an aggregate tonnage of 7,053 tons; while the Tyne and Hartlepool report no sailing vessels built during 1881. But the Tyne continues to lead other rivers in the construction of steel vessels. Four steamers built of this costly metal were launched here during the year just closed. It is significant, however, that these figures show a considerable falling off since 1880. The relative prices of steel and iron plates in January, 1881, were: steel plates, £10 per ton; iron plates, £7 per ton. But now, in January, 1882, the prices are: steel plates, £11.5 per ton; iron plates, £7.5 per ton. It will be observed that steel plates have advanced in price out of proportion with the price of iron, a fact which accounts for the falling off in steel-ship building; for this competition between steel and iron resolves itself into a question of cost. The superior buoyancy and consequent greater carrying power of steel vessels can only claim precedence and obtain preference over iron ships when steel plates can be bought at considerable reduction in the price of steel considered relatively to iron.

The tables submitted on pages following show the growth of ship-building during recent years, as well as the present satisfactory condition of that industry in the north of England. * * *

EVAN R. JONES,
Consul.

UNITED STATES CONSULATE,
Newcastle-upon-Tyne, January 5, 1882.

The aggregates of the number and tonnage of the ships referred to in the tables of the consul foot up thus: On the Tyne in 1881 were built 123 ships with a tonnage of 177,165; on the Wear, 88 ships, 14,488 tons; on the Tees, 34 ships, 58,565 tons; at Hartlepool, 32 ships, 56,541 tons; at Blythe, 10 ships, 7,149 tons; at Whitby, 5 ships, 8,857 tons. The increase in tonnage at these yards in 1881 over that of 1879 was 155,291 tons. The increase on the Clyde, at Aberdeen, and Dundee during 1881 over the tonnage built in 1879, was 159,883 tons.

REPORT BY CONSUL HARTE, OF GLASGOW (1883).

The returns of the Clyde ship-building trade for 1883 have just been published, and the figures show that the greatest activity has characterized the industry during the year. The various firms on the river have surpassed all their previous efforts, the figures showing an amount of new shipping largely in excess of that of any previous year.

It will thus be seen that there were launched during the year by the various firms engaged in ship-building on the Clyde 339 vessels, of an aggregate tonnage of 417,881 tons.

The exact bearing of the returns will, however, be seen by reference to the following table, which gives the amount of tonnage launched during each of the last twenty-six years:

	Tons.		Tons.
1858	22,000	1871	196,000
1859	35,707	1872	230,340
1860	47,833	1873	232,926
1861	66,801	1874	262,430
1862	69,987	1875	211,800
1863	123,262	1876	174,824
1864	178,505	1877	169,710
1865	153,932	1878	215,640
1866	124,513	1879	173,820
1867	108,024	1880	242,774
1868	169,571	1881	340,823
1869	192,310	1882	395,149
1870	180,030	1883	417,881

The majority of the new vessels were built of iron, but a considerable number were constructed of steel, and every year furnishes evidence of the growing favor of steel as a ship-building material.

In 1879 the steel-built vessels amounted to 18,000 tons; in 1880 they aggregated 42,000 tons; in 1881 they rose to 66,609 tons; while last year they reached 108,254 tons. During the present year these figures have been surpassed, the steel-built vessels [illegible] a total of 129,651 tons.

[illegible] of the 52,000 artisans engaged directly and indi- [illegible] between £5,000,000 and £6,000,000, while the sum [illegible] for new vessels launched during the year cannot be [illegible],000, or an increase over last year of at least £1,000,000.

REPORT BY CONSUL LOCKE OF NEWCASTLE. (1883.)

For years past the river Tyne has enjoyed the distinction of being one of the greatest ship-building districts in Great Britain. Her banks, from Newcastle to the coast, contain no less than nineteen great yards, in which are built vessels of every description, from a steam-launch to a twin-screw steel steamer of 3,500 tons. These yards are furnished with all the most improved machinery, with the very latest inventions in every branch of the trade, and the Tyne ship-builders point with pride to the staunch, seaworthy vessels they turn out, a pride that is not unwarranted, as is shown by the fact that during the current week one of the Tyne firms has received an order for the construction of a large twin-screw steamer for use in Her Majesty's service.

That the ship-builders have utilized their advantages, during the past year especially, is shown by a glance at the official returns of the amount of tonnage launched on the Tyne during the year ending December 31, 1883, which show that in that time there were turned out 159 vessels, whose gross tonnage aggregated 216,573. The Clyde, the greatest ship-building river in the world,* whose banks are but a succes-

* The enormous ship-building of the Clyde is the result of the transformation of that river from a fordable creek into a ship-canal. The navigable facilities thus realized, combined with the mineral resources of the district, have raised Glasgow from an insignificant provincial town, having, in 1771, a population of only 35,000, to be the second city of the Empire, with a population of 566,150, inclusive of that of the immediate suburbs, according to the census of 1871; and have made its banks the seat of the largest ship-building trade in the world. Seldom has engineering skill been productive of so much commercial success; perhaps never has it contributed more to individual prosperity than it has done in the improvement of the river Clyde—effected by the labors of Smeaton, Watt, Golborne, Telford, and others. In 1755 the depth

sion of yards, launched in the same time 326 vessels of 417,881 tons; there being 44 firms building on the Clyde, while on the Tyne there were but 19, one of which, the Palmer Iron Ship-building Company, launched a greater amount of tonnage than any one firm on the Clyde.

But the Tyne, while the largest, is not the only ship-building port in this consular district. There is the river Wear, on which, notwithstanding there is in progress an engineer's strike which has lasted six months, and is likely to continue as long, 126 vessels of 212,313 tons were launched; the river Tees, which launched 44 vessels of 81,795 tons; West Hartlepool, 39 vessels of 67,065; Whitby, 8 of 13,662, and Blyth, 5 of 5,869 tons, making a grand total of 381 vessels of 597,277 tons launched on the Tyne and within this consular district, against 326 vessels of 417,881 tons on the greatest ship-building river in the world; placing this coast at the head of the list by 55 vessels and 179,396 tons.

Following is a comparative statement of vessels built in this consular district, and on the Clyde, during the year 1883:

District.	Number firms.	Number vessels.	Gross tons.
River Tyne	19	159	216,573
River Wear	16	126	212,313
River Tees	5	44	81,795
Hartlepool	3	39	67,065
Whitby	1	8	13,662
Blyth	1	5	5,869
Totals	45	381	597,277
Clyde	44	326	417,881
Northeast coast over Clyde	1	55	179,396
Clyde, increase of tonnage, 1883 over 1882			22,732
Northeast coast, increase of tonnage, 1883 over 1882			23,761

The business on the Tyne has been steadily growing, the output of 1880 having been 148,713 tons; 1881, 177,165; 1882, 208,406, and 1883, 216,573 tons. Perhaps a large part of the increase of the past year may be attributed to something else beside the legitimate demand to supply loss by wrecks and permanent withdrawals. The preceding year was one of unusual activity. There was a great demand on all sides for vessels, particularly for iron steamers for carrying purposes. The use of iron in place of wood in ship-building was severely ridiculed and the proposers scoffed at as dangerous dreamers. But experience has shown not only that iron ships are safer than wooden, but that they are speedier and better adapted in every way to the requirements of commerce. But even iron, at the very height of its popularity, is to be supplanted by a more formidable rival—steel. There is a growing disposition everywhere in favor of this change, and last year several of the firms on the Tyne showed their estimation of its desirability by building of steel, where two years ago they would have used iron in the construction of the same class of vessel. In all the list of vessels launched on this coast last year not one of wood is mentioned.

EASTERN COMMERCE DEMANDING A SECOND CANAL.

The strongest lesson to be drawn from the Suez history is to be found in the demands for the much greater facilities in Eastern commerce.

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at low water in the harbor was 1 foot 6 inches. In 1830 vessels of 15 feet draught; in 1839, of 17 feet; in 1854, of 19 feet; in 1861, of 20 feet; and in 1870, of 22 feet draught were safely navigated to and from Glasgow. During the 28 years preceding 1875 15,000,000 cubic yards were dredged from the river. The great economy recently arrived at in the consumption of fuel, and the opening of the Suez Canal, have during the last three years led to the increasing production of screw steamships, and to the almost total stoppage of the building of sailing vessels. (See annual reports of James Deas, engineer, of the Clyde Trust.)

The tonnage of the Suez Canal having attained the margin of the 6,000,000 tons predicted by M. de Lesseps, and the British directors having reported to Parliament their expectation of the doubling this amount at no distant day, the questions of greater facilities for trade and of reductions in the cost of transit have been among the serious topics discussed between the company and shippers, and largely also in Parliament.*

The remedy must lie in one of three plans: the enlargement of the Canal, the construction of a second by its side, or of one on an entirely new route *outside* of the land belonging to the company.

The adoption of the first of three plans was in 1882 announced as fully agreed upon by the English and French directors, who had been lately authorized by the company to expend a larger sum than that previously voted for improvements.

The construction of a second canal by others alongside of the one worked by the present company, is resisted by them as an infringement on their exclusive right granted by the concessions of 1854 and 1855, and confirmed by the Sultan's firman of 1866, in which is the guarantee last "all the concessions, conventions, and former statutes are hereby maintained in all points not contravening this firman." This point may be considered as now conceded by England.

The exclusive right to cut the Isthmus, as vested in the present company, would probably be maintained in the courts.

AN INDIRECT MARITIME CANAL PROPOSED.

A new and "fresh-water maritime canal" for commerce has been proposed to be constructed on a line from Alexandria to Cairo, and from a point about 3 miles below that city to Suez, falling towards each terminus. The distance would be about 122 miles; the number of locks five, two of which would be of a lift of 16 feet. The preliminary estimate of cost is £10,000,000. A *résumé* of this plan will be found in the London Times of October 13, 1882, based upon a report made in 1872 to the Khedive Tewfik by C. E. Fowler, C. E., of London. It will not, however, be forgotten that the International Commission of 1856 reported against the harbor of Alexandria, as calling for larger outlay to render it useful for navigation, declaring also that the idea of crossing the Nile to reach such a roadstead should never be entertained unless an embouchure could be found nowhere else, for by interfering with the very complicated hy-

* Levy, in his History of British Commerce, already quoted, says: "In every respect the hopes and anticipations held out by M. de Lesseps have been fully verified. The Suez Canal is a marvel of engineering skill, and is another illustration of the power of the combination of energy, skill, and capital, nor can it fail to give considerable stimulus to similar works, such as the Panama Canal, to obviate the navigation of the dangerous route between Ceylon and the mainland of India and a canal to separate the continents of North and South America, allowing a free navigation between the Atlantic and Pacific Oceans. We are, indeed, marching further and further in the way of economic progress, and we may expect greater and more rapid strides in the means of international communication by land and by sea."

draulic system of irrigation of lower Egypt it would impose on the leasing company the obligation to remodel that system without the power of self-extension, which it ought to have. The proposition, though favorably entertained by the Viceroy in 1872, has been abandoned.

An index to the struggles through which this canal has passed, and by inference to such as might be expected by any similar work, will be found below:

Letter from Sir Charles W. Dilkes under secretary for foreign affairs, to Mr. W. H. Cooke, secretary of the chamber of shipping of the United Kingdom.

FOREIGN OFFICE, *May* 31, 1882.

SIR: I am directed by Earl Granville to state to you, for the information of the Chamber of Shipping of the United Kingdom, that the memorial inclosed in your letter to this office of the 19th ultimo, was forwarded to the British directors of the Suez Canal Company, and that their report, together with the representation put forward by the memorialists, have now been considered in communication with the Board of Trade.

The British directors observe that these points may be summarized as follows:

1. Ship-owners suffer grievously from the heavy canal dues and pilotage charges levied on vessels passing through the Suez Canal.

2. The pilotage charges are not only unnecessarily heavy in themselves, but the pilotage service might be done away with altogether without jeopardizing the safety of vessels.

3. The dividends of the company having risen from 5 per cent. in 1876 to 9 per cent. in 1880, have thus become free of the difficulties which beset it in the first years of its existence, and may very well now reduce its tariff.

4. As British ships pay four-fifths of the canal dues and charges, it is requested that a large reduction on these dues and charges may be made for the benefit of British ship-owners in particular, and the British Empire in general.

It is to be remarked—

1. As regards the grievance of ship-owners, stress should not be unduly laid on the *obligation to send vessels through the Suez Canal*, and, in making use of the passage through the canal, the considerations hereinafter alluded to should be borne in mind.

2. The pilotage charges are the same as those fixed in 1869, and approved by the International Commission in 1873. Arrangements so made and adopted by the various nations concerned are not lightly to be set aside. The dues in question are intended to cover not only the cost of the pilot service, but other services connected with it, as explained in a foot-note to Article 13 of the Canal Regulations, such as buoys, moorings, and telegraph service along the canal, by means of which the pilots are directed where to shunt vessels into sidings, and thus avoid collision en route.

The discontinuance of the pilot service is out of the question. Recent quarantine difficulties have shown how necessary the pilots are to the safe navigation of vessels through the canal. The greater part of those difficulties arose from so many vessels grounding, owing to the pilots not being in the vessels, but directing them from launches steaming ahead, and as such groundings rarely occur when the pilots are on board, it may be inferred that their absence led to the groundings.

Each occurrence of this kind means the detention of all vessels passing through the canal till the grounded vessel is again got afloat, an operation which requires hours and sometimes days to carry out; it is, therefore, in the interests of ship-owners themselves that the pilot service should be maintained.

Moreover, the company could not be responsible for the safe working of the canal unless they had with each vessel one of their own agents to insure respect for the regulations, by means of which alone can that regularity be maintained which insures the vessel being so passed into the various sidings as to prevent the canal being blocked.

3. Whilst urging as a reason for a reduction of the canal dues, the increase of dividends from 5 per cent. in 1876 to 9 per cent. in 1880, the memorialists appear to forget that *this is an interference with a private concern* which they would not tolerate in their own affairs.

If their own profits from ship-owning exceeded 9 per cent., would that be considered a reason for calling upon them to reduce freights for goods and fares for passengers?

But apart from this consideration there are others which, in the opinion of the British directors, the memorialists seem to overlook.

The shareholders of the Suez Canal Company embarked a very large capital upon an enterprise, the success of which, whether as an engineering work or a financial speculation, was very uncertain, whilst it gave rise to political difficulties which delayed for some years the progress of the work. Thus, for thirteen years they were in suspense as to whether any results would follow from the heavy investment which they had made.

When in 1869 the canal was at length opened, the power of paying 5 per cent. on the capital ceased, and the shareholders had then to wait for any return till the traffic through the canal should increase to an extent which would give them a fair interest on their money. It is only since 1876 that this has been assured, and has begun to exceed the 5 per cent. which M. de Lesseps insured to them during the construction of the work. It would hardly be a fair demand to make upon the company that because they have had during five years a better return for their capital, they should be at once asked to forego this advantage in the interest of individual ship-owners and shareholders of navigation companies who have encountered none of the risks and anxieties which have beset the Suez Canal Company. But, beyond these considerations, there is the further one, that the company are only levying what they have an undoubted right to levy, and that any demand made upon them to reduce their dues would be met by a refusal.

The day may arrive when the company may consider that, in their own interests, it will be advisable to reduce their tariff, or when, in the interests of the public, it may be desirable that these dues should be reduced by means not incompatible with the vested interests of the shareholders; but the British directors submit that such a moment has not yet arrived, for the tariff is undergoing a gradual reduction at the present time of half a franc per ton every year till the 1st of January, 1884, under the Stokes-Lesseps convention.

When the effect of returning to the maximum toll under their concession has been ascertained and the normal revenue been tested by a few years' experience, it will be time for the company to consider the wisdom of reducing their rates. But even then it will, in the first instance at any rate, be a matter for their own initiative, and must depend on the view taken by the board of directors of what is the real interest of the company.

Having regard, therefore, to the considerations above enumerated, Lord Granville desires me to say that Her Majesty's Government do not consider that any sufficient grounds have been shown for taking the action which the memorialists advocate.

I am, &c.,

CHARLES W. DILKE.

This standpoint, however, has not been maintained, as appears from the following:

RESULTS OF NEGOTIATIONS IN 1883 BETWEEN THE ENGLISH SHIP-OWNERS AND THE COMPANY IN REGARD TO THE REDUCTION OF TOLLS AND THE CONSTRUCTION OF A NEW CANAL.

During the last quarter of the year 1883 the ship-owners of the United Kingdom had frequent and urgent conferences with the officers *of the company*, and with the premier and the foreign secretary of Eng-

land, in which they demanded the reduction of the expenses attending the transit through the canal.

Their representations as to this and as to the construction of a second canal, which has been referred to in Consul-General Pomeroy's report as necessary to the more speedy transit of ships, resulted in a joint meeting of the leading representatives of the ship-owners with M. Chas. Lesseps, first vice-president of the company, on the 30th of November, at the office of the Peninsular and Oriental Steamship Company, London, at which prolonged meeting the following twelve points were agreed upon as "constituting the conditions desirable for the future administration of the canal":

MEETING OF NOVEMBER 30, 1883, AT THE OFFICES OF THE PENINSULAR AND ORIENTAL STEAM NAVIGATION COMPANY.

Present, the members of the Association of Steamship-owners engaged in the Eastern trade, Mr. James Laing, in the chair.

1. That to prevent delays in the transit between the Mediterranean and the Red Sea, and *vice versa*, and also to provide for the expansion of trade, the company shall either sufficiently enlarge the present canal or construct a second channel, as may be hereafter determined; and that in order to arrive at a proper decision as to the course which should be pursued in this respect, a commission of engineers and ship-owners shall be appointed to examine the question, of which not fewer than one-half of the members shall consist of English engineers and ship-owners.

2. In addition to the three directors designated by the English Government, seven new directors, chosen from amongst English ship-owners and merchants, shall at once be admitted as members of the board. In order to confer upon these seven directors the power of voting which attaches to the present directors, the administration will propose to the shareholders to modify the statutes and to revert to the figure at first fixed for the number of directors, namely, 32. In the meantime, and until the necessary formalities shall be accomplished, the administration will invite these seven directors, as soon as they have been chosen, to be present at the meeting of the board.

3. A committee (*comité consultatif*) shall be formed in London consisting of the English directors. The company will open an office in London. Arrangements will be made for the payment of dues in London.

4. In future appointments in the transit service the company will increase to a large extent the number of officials speaking English.

5. It is understood that the last surtax of 50 centimes shall definitely disappear from the 1st January, 1884.

6. All expenses resulting from groundings and accidents in the canal shall for the future be borne by the company. From this, however, are to be excepted collisions which may occur between vessels passing through. The Canal Company also except dam ages which may be caused to the craft and other appliances of the canal by ships passing, provided that the ships are to blame for such accident.

7. That from the 1st July, 1884, the company will entirely extinguish the pilotage dues.

8. From the 1st January, 1885, the company will diminish the transit dues by 50 centimes, thus reducing the charge from 10 francs to 9 francs 50 centimes; and should the dividend for 1883 amount to more than 18 per cent., a further reduction in the transit dues over and above the 50 centimes referred to shall be made from the same date, namely, the 1st January, 1885, on the basis of one-half of such dividend above 18 per cent.

That the company will thereafter divide with the ship-owners on every succeeding 1st January, to the extent of half the profits (whatever the amount of such profits may be), in excess of the amount of profits last previously divided with the ship-own-

ers, which moiety is to be applied to a reduction of dues determined upon the basis of the tonnage which has passed through the canal in the year for which such profit is ascertained. For example, if the accounts for 1884 show profits at the rate of 20 per cent. the ship-owners would be entitled to a reduction in the tariff equal to the net profits of the company corresponding to one per cent., about 2,800,000 francs, for the year commencing 1st January, 1886, over and above the previous reduction; and again, if the profits on the revenue of 1885 should be 21 per cent., a half share of the difference between 20 per cent., and 21 per cent., viz ½ per cent., say, in round figures 4,400,000 francs, will go towards the reduction of dues from the 1st of January, 1887, over and above the previous reductions; and this division by moieties will continue until a profit of 25 per cent. is reached. Above such profit of 25 per cent. all the net profits of the company shall be applied to the reduction of dues until such dues are reduced to 5 francs.

9. It is understood that in the foregoing clauses the profits on which the reduction of dues is to be calculated, shall include the 5 per cent. paid in the first instance to the shareholders.

10. The reduction already agreed to in favor of ships in ballast is to be confirmed.

11. As to the statutory reserve, the council of the Suez Canal Company will propose that when such reserve shall have reached the sum of 5,000,000 francs, the deductions thereafter to be made from the net profits, for the benefit of such reserve, and which are now at the rate of 5 per cent., shall in no case exceed a maximum of 3 per cent. on such net profits.

12. It is understood that the calculations on which the aforementioned reductions in the tariff are to be arranged are based upon the present capital of 200,000,000 francs. In the event of any change being made in the amount of such share-capital, the basis for the reduction of dues shall be readjusted so that the diminution in the tariff shall not be adversely stated.

In regard to these very important reductions in the charges for ships and travel across the Isthmus, it will readily appear that they show a full expectation on the part of the ship-owners of England of a still largely increasing trade with the East. The canal is indeed altogether inadequate to the wants of to-day. Large sums, as has been shown in this statement, are expended in its enlargement, but the demands of commerce are not met. The seemingly unreasonable demands of English merchants in their complaints of the large dividends realized show that they have forgotten the old English opposition to the building of any canal, and the reductions in the cost of travel across the Isthmus and to India, which the canal itself has effected. In the conference held with Lesseps in July, 1883, the British directors agreed to advocate the offices of England in securing from the Khedive concessions for the land for a new maritime canal, for a fresh-water canal from Ismailia to Port Said, and for the extension of Lessep's concession 99 years from the date of the opening of a new canal; also to secure from the English Government a loan of £8,000,000 at 3½ per cent. for the new works. These terms were not accepted by the Government, but it is fairly to be presumed that these three propositions will be *practically* carried out.

The pilotage dues now given up in 1882 netted $700,000.

NEUTRALIZATION OF THE CANAL.

The problem is at this date an item of discussion among the great powers.

Mr. G. W. Vyse, lately on special duty in Egypt for Her Majesty's Government, says:

Egypt, long known as the bone of contention for European powers, continues to present much the same object to the same chiefly interested states, England and France. The existing relations, says a recent writer, between England and Egypt are daily becoming more complicated. Various nations have acquired vested interests there, which would, under certain circumstances, justify diplomatic interference. Egypt is more than ever inclined to separate herself from the Sultan's power if England will help her. The Khedive is reduced to a vassal of the Sultan, who in turn is a vassal of the Czar of Russia. Russia, perhaps, is anxious, or at least willing, that Egypt should fall to the share of England, and Turkey, according to Lord Dufferin, would surrender it for a consideration. The canal is valueless to England without command of the Delta. In regard to this it may be admitted that as long as the international highway to India is not endangered, the country should be allowed to manage her own affairs.

'The command of the canal is essential to the safety of the Indian Empire, and it can only be secured by the occupation of the Isthmus; we shall not act up to our obligations towards India if we fail to occupy the Isthmus when it lies in our power to do so.' Mr. Gladstone agrees so far with Mr. Dicey in this as to admit that, under certain conceivable circumstances, it might be our duty to occupy Egypt for the protection of India. * * * The command of the Suez Canal is daily becoming more and more important to us in order to secure our free communications with India, and in the event of the overthrow of the Ottoman Empire, it will become absolutely essential to our safety to secure the command of the canal, and to do this we must hold the Isthmus. Those who doubt the accuracy of these statements should open a chart of the world and inspect for themselves the position of the canal, lying as it does as a sort of land-lock in the very center of our route to India. It is the great toll-gate between the east and the west, and it is most important, for political and strategical reasons, that we should have the power of keeping it open at all times for our ships.

There can be no doubt that, owing to the peculiarity of the structure of the canal, it could very easily, in a very short time, be rendered perfectly useless by a company of sappers and miners, thus constituting the canal impassable for months (or blocked by a sunken vessel). The marvel is that when Lord Beaconsfield was in power he did not annex Egypt instead of Cyprus. He went half way, and suddenly stopped. The purchase of the Suez Canal shares for £4,000,000 met with the applause of the English nation, both Conservatives and Liberals agreeing that it was a very wise step. But the Suez Canal is the *point d'appui* of our hold on India. The direct control of it by England appears to all thinking Englishmen as absolutely essential, and of the highest and most vital importance. *It may, for various reasons (political), be delayed, but it is inevitable that sooner or later* we *must* make the Suez Canal *British property.*

In addition to the oft-repeated statements of the present difficult position, other and grave complications since the late war (1882) in Egypt have grown out of a jealousy of French influence there, and out of the conflicts arising among the heterogeneous populations under the jurisdiction of the courts of the mixed tribunals. The jealousy of the French control of the canal is expressed in such language as this:

It would have been better for the Pasha to have held to the old ideas of intercommunication between the Nile and the Red Sea only, as did the Ptolemys, the Caliphs, and Mehemet Ali, the predecessor of Said Pasha, for in place of Egypt's having become, as was promised, a great power by her possession of the new route, she has but opened it, as was foretold to Amrou, "to the barbarians of the west." She is to-day the bone of contention for European powers. "The time is perhaps not far off when the man-

agement of the Suez Canal must change its character, and its neutralization under international control will probably be its next phase."

In this connection it is to be noted that during the recent hostilities between Russia and Turkey, Earl Derby did not hesitate to announce to the Russian Government the impossibility of England's maintaining her neutrality if Russia should transfer hostilities to Egypt, affecting at all the freedom of the canal. He was promptly answered by Prince Gortschakoff that the imperial cabinet had held no intention either to blockade the Suez Canal or to hinder or in any way threaten its navigation. It considered the canal as an international work in which the commerce of the whole world is interested and which ought to be secure from every attack. Egypt is indeed part of the Ottoman Empire, and contributes her contingent to the Turkish army, and Russia could therefore consider herself as at war with her, but she did not lose sight of the European and especially the English interest in that country, and "would not consider that Egypt was within the theater of military operations."

In regard to the general question of neutrality of newly opened routes of commerce, the "Moniteur Universel" has quoted M. de Lesseps as having said:

"When it was proposed to me to have an understanding with the different governments that negotiations might be entered into to secure the neutrality of the Suez Canal, I did nothing, persuaded that such negotiations would secure no result. After consulting with M. Thiers and Prince Metternich, I recollected that up to our day the policy of governments had been opposed to any hindrances to the free passage of war vessels and troops; that it was contrary to the act of concession granted by a territorial government, which act assured the entire neutrality to ships of all nations on equal terms.

The following correspondence is of interest as bearing on the now apparently increasing difficulties between France and England in regard to Egypt.

M. de Lesseps, writing to Mr. Gladstone July 20, 1883, in regard to a previous agreement presented to the English Government, says of it:

This agreement, considered and drawn up in concert with Her Majesty's ministers, had in view our principal joint intentions by insuring the excavation of a maritime channel parallel with the present one within the shortest time possible, and provided for the reduction of tolls in conformity with the promises lately formally made to the share-holders and the ship-owners.

In France public opinion, forgetful of the past, has unanimously approved this agreement; in England, it seems to me that a section of public opinion which has, perhaps, pronounced itself hastily, has not understood the full scope of the equitable arrangement arrived at; and unfortunate discussions between the two friendly nations have resulted, which, I fear, are capable of *injuring deeply* and for a long period the necessary sentiments of *cordial friendship* which united the two nations. Personally, I should much regret that the work of peace, carried out in Egypt by French capital in the interests of universal commerce, should become a pretext of disunion, and that Europe should witness the development in the parliament of England, and under your liberal ministry of an error of judgment leading to a failure of justice.

In the interests of general peace, in the interests of the Franco-English alliance, indispensable to the civilization of the world, I beg you not to consider yourself bound towards the ship-owners and towards myself by the terms of the agreement which we have signed.

Our Council of Administration holds, under the Statutes of the Company, sufficient powers to decide upon the excavation of a second maritime channel, and to settle the tariff to be levied, and our share-holders are in a position to provide us with the means for excavating the second canal.

Consequently, I formally declare that if our agreement should be suspended, or even canceled, the excavation of the second maritime canal will be immediately carried out, and all the reduction of tolls provided for in that agreement will take effect.

We shall thus continue peaceably and amicably as heretofore, in agreement with the representatives of the Queen's Government on the Council, to carry on and improve the Maritime Canal according to the requirements of a work designed to remain freely open and available to the fleets of all nations, without exclusion or favor, according to the terms of our concession.

Receive, &c.,

FERDINAND DE LESSEPS.

REPLY.

(Parliamentary report, Egypt, No. 15, 1883.)

10 DOWNING STREET,
Whitehall, July 23, 1883.

MY DEAR M. DE LESSEPS: I have the honor, on behalf of myself and my colleagues, to acknowledge the receipt of your letter of the 20th.

I have undertaken to thank you for apprising us in a manner so frank and friendly that, so far as you are concerned, you regard us in no way bound, under the existing circumstances, to press* the agreement on Parliament.

I am also to thank you for having in a similar manner made known to us, for the information of Parliament and the country, the independent and spontaneous action, with a view to enlarged means of communication through the Isthmus, which you intend to propose to your share-holders.

I remain, &c.,

W. E. GLADSTONE.

On the subject of neutralization Lesseps has said:

"During ten or twelve years overtures on this subject between the different Governments were made, and I made no objection to them. With the most complete freedom the Suez Canal was opened to all vessels, whether national or merchant, and no inconvenience has resulted, from which I conclude it would be the same for Panama.

"It is a fact that on the 15th of August, 1870, when war was declared between France and Germany, and our troops were before the Germans, the canal was opened to all vessels, and in the basin of Lake Timsah there were a French war vessel, an Egyptian ship, and a German. It was the birthday of the French Emperor, and, according to the usage of all ports, the French ship hoisted her colors and the German and Egyptian followed. When I returned to Egypt after the siege of Paris the Khedive told me of this, adding, 'We have made a real neutrality, have we not?'

"I concluded then, as far as I was concerned, I would be entirely passive on this question. There may be negotiations entered upon as regards the American canal before and after its opening, but there will be no practical result. Neutrality will be naturally accorded to the new strait. If the North Americans propose to protect that canal by themselves alone, the English and the Germans will not agree to it.

"Besides, it is not to be supposed that, when the question is understood, a people so intelligent and practical as are those in the United States will be willing to attack the independence of a state which they themselves declared sovereign at the time of its emancipation from Spain. The Monroe doctrine is nothing less than the recognition of the sovereignty of the South American states.

"The nation which declares the freedom of the seas, and has always sustained it in its negotiations, cannot by opposed to the freedom of straits, whether natural or artificial"

*The opposition to the "agreement" referred to was very strong in Parliament and among the shippers, effecting the failure of its adoption.

But a clear lesson on the problem of neutrality can be drawn from

THE OCCUPATION OF THE CANAL BY THE ENGLISH.

In the summer of 1882, in consequence of a movement in Egypt, which was regarded as a military rebellion, the object of which was supposed to be the abolition by violent means of the control and the removal of foreigners generally from positions of influence held by them in Egypt, England intervened, subdued the rising, and restored the authority of the Khedive.

A British force remained in Egypt as an army of occupation, which, in December, 1883, numbered 6,763 officers and men. (Statesman's Year Book, 1884.)

The positions of influence here referred to were those of controller-general, member of the International Commission, and others, offices invested with large powers to examine the whole financial situation of Egypt and regulate its relation to its creditors. The number of the offices thus held, chiefly by the English and French, with high emoluments, was extremely obnoxious to all classes in the country.* The burdens of taxation on the fellahleen were increased.

In the short campaign (twenty-five days) of the intervention the chief events were the bombardment of Alexandria, July 11, the military occupation of the Suez Isthmus, August 19 to September 16, involving the seizure and temporary closing of the canal, and the battle of Tel-el-Kebir by a force advancing from Ismailia. Of these the occupation of the canal only links itself with this narrative.

The probability of warlike operations showing itself after the massacre at Alexandria, the plans of General Wolseley involved the occupation of the Suez route as a military necessity. The plan was formed in England early in the month of June. July 28 the war may be said to have been officially begun; the first detachment of troops from India, designed to occupy the port of Suez, had left Bombay one week before. August 8 an increase of force arrived from Aden, and before the close of the month the Indian contingents had occupied the southern half of the canal, driving off the forces of Arabi from different points between

* General Loring, formerly of the United States, late Féreek Pasha in the Egyptian service, says: "As soon as it became evident that Egypt was to be the prey of England, an army of officer-seeking vultures from every land where she holds sway descended upon the prostrate victim to fatten at their leisure on her vitals. France supplied but few of these birds of prey. Those in power had already voted themselves $25,000 and $30,000 salaries; the native clerks were cashiered, penniless, with their salaries in arrears. To make this outrage still more patent, care was taken by the comptrollers and the commissioners to pay themselves and their foreign friends every cent of their enormous salaries. To add still more to this extraordinary state of things, the army received no pay. Their pay, too, was in arrears. Officers were in rags; their wives and children clamoring for bread. The fellah groaned as he paid his last piaster for taxes, and all means were exhausted to wring more out of him."—(A Confederate Soldier in Egypt.)

Suez and Ismailia, and establishing guards along the line of the railway for its protection.*

The seizure of the northern half of the canal and its short closing to commerce began August 20; the entrance by the navy through Port Said had been planned as early as July 9, at which date two gunboats left England for "contingent use in the canal." On the 20th the British had a foothold at Alexandria and at Suez, besides strong naval forces at Port Said and Ismailia; Egyptian detachments in the interest of Arabi held Port Said and Ismailia. Except Suez and Alexandria all Egypt was in his possession, and his force numbered 50,000 regulars, with uncounted volunteer Bedouins. The canal itself was still open to traffic, vessels coming and going through it as usual unmolested. On the last-named date, at 3.30 a. m., the naval force from the British transports which had left Alexandria ostensibly to attack Aboukir, landed without observation at Port Said, and surprised the Egyptian garrison, their sentries being asleep at their posts. Within the few days which followed, Kantara, Ismailia, and each of the stations in this section of the canal were fully occupied. All ships in the canal or entering the port of Suez were stopped by military force, and the entrance to the Fresh-Water Canal and its line, the railway, and telegraphs were seized. The occupation of the canal secured the closing of the campaign and of the war.

The administration of the canal, says Lieutenant Goodrich, was in the hands of the British nearly three days, the company's employés having orders from Count Ferd. de Lesseps, the president, to abandon their work. Lesseps' influence with Arabi had saved the blocking of the channel; he himself had believed that the English would not dare to make use of the canal as a military base because of his belief in its inviolable neutrality. The respect of neutrality as regarded Egypt by the Russians in the war of 1870 will be remembered. Admiral Hewett when occupying Suez now announced in reply to the protest of M. Lesseps, that the act was under the orders of his government as a military necessity and for the protection of the place. On this basis the complete seizure and occupation of the canal were made and continued; an occupation which would undoubtedly have been prolonged, had it been necessary, until the English had secured success.

Their advance upon the forces of Arabi from the new base of the canal relieved the commerce of the world. M. de Lesseps telegraphed from Port Said, August 25, "the transit of ships is re-established and freely administered by the personnel of the company, who have not been at fault (bronché)." The company's administration had been suspended and the war fleet had passed through, piloted by English naval officers. This, as well as the first entrance and occupation, had been under the

* For most of the statements of the occupation here given I am indebted to the report on the British military and naval operations in Egypt, 1882, made to the Navy Department, by Lieutenant-Commander C. F. Goodrich, United States Navy.

strongest protest from the chief agent of the "Maritime Canal Company of Suez," Victor de Lesseps, and from the president; the protest from the office of the company in Paris denying "the claim of the English Government, which calls itself the Khedive's agent, to carry out any enterprise on the whole or a part of the canal or its dependencies. No one, even with the Sultan's authorization, and, à fortiori, without that authorization, had a right to disturb the company in the free and peaceful enjoyment of its concession."*

The result of the conferences held between the English officers and those of the company was the admission of "the responsibility for the delays occasioned to the commerce of all nations." This, of course, implied the fullest indemnity for the interruption and for the transit of the British fleet-ships and soldiers. In his notice of the Suez Canal, visited in 1869, Professor Mitchell, United States Coast Survey, said:

I have looked in vain through the entire history of this French enterprise in Egypt to discover the least trace of earnest effort or sincere co-operation on the part of the Egyptian or Turkish Government. I believe that the viceroys of Egypt, from Mehemet Ali down to the present weak prince, have been coaxed into acquiescence by the master minds that conceived and executed this brilliant work; and I am convinced that this costly avenue, and the commerce employing it, will never be *secure from interruption till the territory is neutralized or otherwise wrested from Mohammedan misrule.*

The lessons of history are indeed too clear to permit the expectation of such welcome news as a conformity by the stronger powers with any full provisions for neutralizing a highway, if an occasion like that of 1882 in Egypt should at any time recur. Would treaties bind a Napoleon to neutrality? Is it for a trifling purpose that England has established her cordon of fortifications from Suez to Aden, and can command access from the Mediterranean to Port Saïd by her ships at Cyprus, Alexandria, and Aboukir? Lieutenant-Commander Goodrich has well said in his report on the occupation of the canal, "The inference to Americans is obvious that the neutrality of any canal joining the waters of the Atlantic and Pacific Oceans will be maintained, if at all, by the nation which can place and keep the strongest ships at each extremity." A possible relief in the question of neutrality may be, that, inasmuch as

* Article 14, of the Pasha's concession of January 5, 1856, confirmed by the Sultan's firman, reads thus: "We declare solemnly, for ourselves and our successors, subject to the ratification of H. I. M., the Sultan, the Great Maritime Canal of Suez to Pelusium, and the ports belonging to it, *open at all times, as neutral passages* to every merchant vessel crossing from one sea to the other, without any distinction, exclusion, or preference of persons or nationalities, in consideration of the payment of the dues, and the performance of regulations established by the universal privileged company for the use of the said canal and its dependencies." The entire ignoring of this article by the Pasha may be accounted for, on his side, by the seeming necessity for his so doing in order that the English could succeed in the war for his defense against rebellious subjects. The acts of the British commanders, Wolseley, Hoskins, and Hewett, were based on a decree of the Khedive, dated Alexandria, August 15, which recognized "the military occupation charged to re-establish order in Egypt, and authorized them to occupy all the points necessary."

the Four Great Powers are all increasingly interested in the uninterrupted freedom of the canal, if one shall threaten seriously to delay the passage of the ships of the others, the three may prove a restraint.

CHRONICLE OF EVENTS IN THE HISTORY OF THE SUEZ CANAL.

The enterprise studied by Lesseps, 1849 to 1854. First concession, 1854. Subsequent concessions, 1856, 1863, 1864, 1866, 1869, and 1876. Company organized, 1858. First blow struck, 1859. The Mediterranean admitted to Lake Timsah, 1862. Transit by a small vessel, 1865. Inauguration of the canal, 1869. The estimated tonnage of 6,000,000 tons reached, 1884. A new canal demanded. Decision to double the width of the present canal. Revenue, 1870 to 1874 (3 years), $6,112,129; revenue for the *one* year 1883, $13,702,413. Expectation of 10,000,000 tons in 1888 is reported by the British directors. Dividend of 1882, 17 per cent.; dividend expected in 1890, 30 per cent.

In reply to an inquiry as to the rumored sale of the canal to England, M. de Lesseps, at the date of July 31, 1884, says: "You were right in believing that we know nothing of a proposition for the sale (*rachat*); and the recent arrangement entered into between the company and its largest customers, and which has been approved by Her Majesty's Government, seems to me the best proof that the delusive idea has been dissipated, *ecartée*. We had no reason to suppose that the Government of Her Majesty had the intention of purchasing during the occupation of Egypt the shares of the Suez Canal which she does not possess."

DIMENSIONS.

Length, 88 nautical, 100 statute miles; slopes of sections originally 2 to 1 and 5 to 1; breadth, 190 to 330 feet; curves radii, 2,000 feet; length of jetties, 6,940 and 6,020 feet.

COST TO DATE OF 1884.

From the best available sources, estimated at $95,000,000. It could be built to-day for two-thirds of the sum. Professor Mitchell, who inspected the work in 1869, remarks that the shore at Port Said is peculiarly favorable for construction in fascines; and that "jetties like those on the canal works in Holland would have been entirely successful. It is true that Egypt supplies little material for this kind of work."

RAINFALL—CLIMATE.

The total rainfall at Ismalia through the year 1868 was 1¼ inches. The climate of the isthmus is stated by Professor Mitchell to be healthy, and although the sands occasionally heat up to 130°, the extreme summer temperature of the air in the shade does not usually exceed 95°. The summer nights are cool, with refreshing breezes, the rainfall is increasing.

THE SUEZ CANAL AND THE AMERICAN CANAL.

The importance of the construction of a canal across the American isthmus has been fully and continuously set forth by the Presidents of the United States, the heads of the State Department, and leading statesmen in both houses of Congress.

As early as 1835 President Jackson employed Mr. Charles Biddle for the purpose of making inquiries into the present state of the projects for uniting the Atlantic and Pacific Oceans through the Isthmus of Darien. In 1839 an elaborate report on the whole subject was made by Hon. C. F. Mercer, of the House of Representatives. In 1846 the Secretary of State communicated to the Senate a number of valuable papers on the subject, including a memoir from Mr. Wheaton, then our minister to Prussia. February 20, 1849, Hon. J. A. Rockwell presented to the House of Representatives a report embracing 658 pages, and including, seemingly, everything valuable in the history of the problem to that date. Among its papers were the reports of Moro for Tehuantepec, of Bailey for Nicaragua, and Garella for Panama, with communications from Messrs. Stevens, Hughes, and Maury in relation to the then proposed Panama Railroad. In 1851 President Fillmore said in his message to Congress:

> In investigating upon this important subject this Government has had in view one, and only one, object. That object has been, and is, the construction or attainment of a passage from ocean to ocean, the shortest and the best for travelers and merchandise, and equally open to all the world.

Strong expressions of unanimity in this judgment may be found in the messages of succeding Presidents. The geographical and political relation of the United States to the opening of such a highway was forcibly presented in the message of President Hayes, March 8, 1880:

> An interoceanic canal across the American isthmus will essentially change the geographical relations between the Atlantic and Pacific coasts of the United States and between the United States and the rest of the world. It will be the great ocean thoroughfare between our Atlantic and our Pacific shores, and virtually a part of the coast line of the United States. Our merely commercial interest in it is greater than that of all other countries, while its relations to our power and prosperity as a nation, to our means of defense, our unity, peace, and safety, are matters of paramount concern to the people of the United States.

The messages of President Arthur and letters of Secretary Frelinghuysen have been of like tone.

Repeated declarations on the floors of Congress have accorded with the judgments of Senator Windom, of February 28, 1881, when, inviting attention to the map of the world, he said:

> Starting from a point near the extreme southern boundary of Mexico, there is a narrow neck of land, extending southeasterly more than 1,500 miles, washed upon the one side by the waters of the Gulf of Mexico and the Caribbean Sea, and upon the other by the Pacific Ocean. Bordering upon the Gulf on the north lie the great States of Texas, Louisiana, Mississippi, Alabama, and Florida; north of these lies that mighty empire drained by the Mississippi River; while to the east are the Atlan-

tic States, stretching from Florida to Maine. On the Pacific are the States of California and Oregon, and Washington Territory; and from the Atlantic to the Pacific stretches a domain whose magnificence is the pride of every American. Obstructing, embarrassing, and burdening the commerce between these great sections of the Union lies this narrow strip of land, at some points not over 45 miles in width.

To avoid it, the 1,200,000 tons of wheat raised in California and Oregon last year are compelled to seek a European market by a costly and tedious voyage of 14,000 miles around Cape Horn. Even the exchange of products between our own Atlantic and Pacific States must be made by the same circuitous, expensive, and dangerous route, or else submit to the heavy burdens imposed for railway transportation across the continent. The commerce of all the leading nations is in like manner obstructed and burdened. The time has come when this barrier is about to be removed. The wonder is that it has been permitted to remain so long.

To the advantage of an American canal, constructed upon whatever line across the isthmus may be considered the best, it may be conceded that a portion of the sailing tonnage of Europe, trading with China, Japan, and Philippine Islands, Borneo, Celebes, New Guinea, Australia, and possibly Java and Sumatra, would pass through the route.

Besides these countries, the western coasts of South America, and especially the California interests, must come into view. A ship canal across our isthmus would probably develop on these coasts, and under our advancing relations with China and Japan, new activities in commerce, equal if not superior to those which have been stated as stimulated by the opening of the Suez route.

The canal would open direct and cheap transportation for many thousands of emigrants to the Pacific coasts, give rapid and cheap carriage for the products of extensive and fertile regions, cause a quickened development of our Pacific empire, and would prevent combinations designed to maintain high freight and passenger charges.

Opening a line of economical water transportation to markets beyond the seas for those bulky and cheap products that cannot bear extended railway carriage, must rapidly develop agriculture—the basis of all solid prosperity—induce emigration, give rise to new industries and occupations, develop new resources, urge to activity in all walks of life, and create a business for railways far in excess of anything before enjoyed. The prosperity of our railway lines in their competition with an active river, lake, and canal traffic illustrates the possibilities of such competing means of transportation. The wonderful growth of wealth and population in the Mississippi Valley region, and consequent expansion of railway interests, is the result of that continued cheapening of carriage arising from improvements in land transportation and the competition by water; but trans-continental railways can hardly become economical in the sense that the great trunk lines are to that valley. They have made valuable for agricultural purposes those fertile plains of the great West which otherwise had remained pasture lands, populated only by scattered herdsmen, and they have reaped, in return, the active railway business we to-day witness.

An emigration of large proportion, induced by whatever cause, will give to the Pacific side that needed population, in the train of which will follow all the beneficial consequences to the carrying interests experienced on the Atlantic side, varied only by differences in the character of the country, and in the consequent pursuits of men. The great railways reaching across the continent will then find it necessary to stretch out numerous arms and feeders, such as have given colossal proportions to the lines from the Atlantic coast to the interior.

To people and develop the Pacific States is of great national importance, and the general views entertained in this regard have been exhibited by the liberal aid ex-

tended by our Government to lines of communication. The enterprising people of that coast are realizing now the need for facilities of carriage by more economical routes. One million tons of surplus wheat are there to be transported to the world's market, and the means are not only inadequate, but the markets are reached by vessels passing around Cape Horn. The farmer is crippled in his efforts to compete with those more favored, and with depressing influences bearing upon that industry follows depression in all others.

Considerations respecting rates of toll and other canal charges have special interest for the people of this country, not only because the canal should afford economical transportation for our Pacific-coast possessions, but also because it will be the water highway of an inter-State commerce between two great coast lines extending for thousands of miles on both the Atlantic and Pacific Oceans. In this trade no other nation has, or can have, a direct interest. It is one to be conducted exclusively by American shipping.

If we regard the near future, when many millions of industrious people will inhabit the Pacific States,* and the coast trade shall have grown to great proportions, we perceive the importance of canal dues in their bearing upon this exclusive national interest. It is a question differing entirely from that relating to exactions imposed upon our foreign commerce, and borne in the same degree by the shipping of all nations. * * *

The emigration to the Pacific Slope during the past ten years is reported by the Bureau of Statistics to have reached only 14,500 annually. What number will it attain to when direct steamships can carry without transfer, in greater comfort, far less exposure, and at a small fraction of the present cost? What revenue may we not set down for this business at $5 per passenger for the canal transit?

It is also certain that favoring conditions of temperature and navigation would attract a large and growing tea trade by way of the canal, and effectually stop any carriage of it, to this country at least, via Suez. The development of the Central American States, under the impetus of the canal, would also become an important factor in the increase of business to be expected, and this is another advantage this route has as compared with that by Panama. Nicaragua and the adjoining States have a soil of unsurpassed richness for all tropical products, and coffee cultivation has already become a very important industry. (Remarks of Capt. (now United States minister) S. L. Phelps before the Committee on Foreign Affairs, House Report 16, Forty-sixth Congress, third session.)

An important element tending to show the superior advantages of an American canal over that of Suez is to be found in a comparison between our inland Mediterranean and the European sea in respect of the natural products received by each through its river drainage. Lieutenant Maury, years ago, called attention to the important physical fact that the rivers of our Mediterranean bear upon them to that sea the products of different climates, and this eminently in the case of the Mississippi and its large tributaries; a marked point in connection with the immense development which the great valley is steadily showing. What measurement can be made of the products of the different climes which would be borne down that valley when a ready market shall be offered for these by exchanges in the ports of Asia through an open-water highway? The Gulf of Mexico with its waters have never been utilized as they

*The consul of France at San Francisco, in his official report of the present year, writes: "The richness of the California soil is not inferior to that of France; if we consider, then, the relations between superficial area and population, California can maintain about 30,000,000 of inhabitants."

should be by so progressive a people for the development of our expanding commerce. Now that the bar has been removed from the mouth of the great river, let a ship-canal be thrown open across the most feasible route on the American isthmus, the natural products and industries of the great West must be further stimulated for exchange on the eastern shores of the Old World.

Suez is the center of the old continent; Darien, the center of the great oceans, the Atlantic and Pacific, of the water as well as the land of our globe.

As a further contrast, remembering that sailing vessels cannot use the Red Sea, two important factors in the navigation of the American canal are brought into view; viz, the assistance to sailers by the Gulf Stream and that afforded by the trade-winds of the Pacific.

Lieutenant Maury may here be again quoted:

From the Gulf of Mexico all the great commercial markets of the world are downhill. A vessel bound from that Gulf to Europe places herself in the current of the Gulf Stream, and drifts along with it at the rate, for part of the way, of eighty or one hundred miles a day. If her destination be Rio, or India, or California, her course is the same as far north as the island of Bermuda.

And when there shall be established a commercial thoroughfare across the isthmus, the trade-winds of the Pacific will place China, India, New Holland, and all the islands of that ocean down hill also from this sea of ours. In that case, Europe must pass by our very doors on the Great highway to the markets both of the East and West Indies.

This beautiful Mesopotamian sea is in a position to occupy the summit level of navigation, and to become the great commercial receptacle of the world. Our rivers run into it, and float down with their currents the surplus articles of merchandise that are produced upon their banks. Arrived with them upon the bosom of this grand marine basin, there are the currents of the sea and the winds of heaven so arranged by nature, that they drift it and waft it down hill and down stream to the great market places of the world. * * * The area of all the valleys which are drained by the rivers of Europe that empty into the Atlantic, of all the valleys that are drained by the rivers of Asia which empty into the Indian Ocean, and of all the valleys that are drained by the rivers of Africa and Europe which empty into the Mediterranean,—does not cover an extent of territory as great as that included in the valleys drained by the American rivers alone which discharge themselves into our central sea. Never was there such a concentration upon any sea of commercial resources. Never was there a sea known with such a back country tributary to it.

The projector of the canal which has been begun across the Isthmus of Panama has more than once estimated the advantages of an American route as superior to those offered by the Isthmus of Suez. In the proposal for the new route issued by the "Compagnie Universelle du Canal Interoceanique," it is alleged that the cutting of the American Isthmus would shorten the distance for ships from one ocean to the other by an average of 3,000 leagues; that the saving of money resulting from the shortened time and the security of navigation will be 80 francs per ton; that the receipts from the transit dues alone (15 francs per ton on the estimated tonnage of 6,000,000) will bring a gross annual revenue of 90,000,000 francs; and that, as the expenses of maintaining the canal when once opened need not exceed 35,000,000 francs, the stockholders

may expect a return of more than 11 per cent. besides the interest of 5 per cent. guaranteed to them from the date of their investment.

It is plain, however, that even in the light of the experience of the Suez Canal all *estimates* here are to be received as contingencies. The uncertainty attending estimates is aptly illustrated by the predictions at the opening of the Suez Canal that it might profit the outward but not the return voyage; especially being hopeless for the Australian trade. In 1884 large returns are being made from Australia.

THE AMERICAN PROBLEM A MUCH MORE SERIOUS ONE THAN THAT OF SUEZ.

The natural differences between the Isthmus of Suez and that of Central America are plain to the eye which rests upon a relief map. The greater difficulties to be met with on the American lines are at once apparent. Suez is an arid, sandy, longitudinal depression, of which more than one-half is below the sea-level. The isthmus of Central America is chiefly a ridge of the Cordillera. To cross the isthmus of the old world is to encounter its sands, but scarcely an elevation, as has been shown, of more than 60 feet. To cross the tongue of the new world is to ascend elevations, in Honduras, from 2,000 to 3,000 feet; in Panama, the line of the lowest level, those of from 280 to 470. The summit level of the Panama Railroad is 263 feet above the mean tide level of the Atlantic.

The contrast between the two isthmuses will appear yet more plainly from a cursory examination of what has been learned by the reconnoissances and surveys on the principal projected lines for a ship-canal across America. Taking these in geographical order they range from north to south as the Tehuantepec, the Nicaragua, the San Blas, the Panama, and the Atrato routes. The following statements have been prepared with care from the reports of the several important explorations made under the Navy, and from some personal intercourse with their chiefs, when on duty under the Department on this subject. The tone of the intelligence received within the present year from United States officers on the Isthmus of Panama, and the failure of any practical movement in Congress toward a canal prompt the statements:

THE TEHUANTEPEC ROUTE.

It will be conceded with Captain (now Admiral) Shufeldt that a ship-canal across this part of the isthmus would become a part of our internal water communication, as well as afford a channel for our external commerce and that of the world; that it would be the shortest route between our eastern and western possessions; and that, for reasons clearly set forth in his report, it would be, both in a military and commercial point of view, a route of the first importance. It was so considered at the close of the war between the United States and Mexico, when

our peace commissioners were authorized to offer to Mexico a large sum for the right of way. But the anticipations then and afterward entertained of the feasibility of the route were unfortunately dissipated by the reconnoissances made under Captain Shufeldt in the year 1871. The old reports of the summit elevation and of other points entering essentially into the question of a canal were found to have been erroneously stated. The summit level was ascertained to be at least 784 feet; no possibility exists of uniting the streams needed for a feeder, and the number of locks required for a ship-canal is one hundred and forty, a number itself more than sufficient to debar from the commerce of this age all thought of a canal. It was a work of value to eliminate this route from the problem. The United States were fortunate in saving in 1847 their offered millions. (Report of Capt. R. W. Shufeldt. Senate Ex. Doc. No. 6, second session, Forty-second Congress.)

THE NICARAGUA ROUTE.

Full instrumental surveys have been made on this line. If we except those made by the engineers of the Panama Railroad and those by the Americans and French in Darien and Panama for a canal, these across Nicaragua are indeed the only full surveys made on the isthmus. The examinations of the line may be summarized as follows:

In 1851 a survey by Col. O. W. Childs, C. E., located a route from the already shoaling harbor of San Juan del Norte (Greytown), on the Atlantic, to the so-called harbor of Brito, on the Pacific.

The distance laid down by him was 194 miles. The canal would require 28 locks. The estimated cost was but $13,000,000.

The plan was approved by engineers of the United States Army, but failed of execution for want of encouragement in England where the capital was sought, chiefly from a partial disapproval of the plans for the harbor of Brito and the general dimensions of the work. The proposed depth was but 17 feet for the canal and its locks.

Fifteen years afterward, Mr. P. C. F. West, C. E., of the U. S. Coast Survey, reported to the Central American Transit Company of New York that "after carefully studying the question of the permanent improvement of Greytown Harbor to admit ocean ships," he was "obliged to abandon the idea. The harbor could be improved, but not permanently; for the same causes which had occasioned its decay were still at work and must insure its inevitable ruin." The anchorage had then become a lagoon with an uncertain inlet. The opening at Greytown closed in the month of May of the year in which West completed his survey. The cove which had opened to the northward was changed to a lagoon by a mole of sand driven across the mouth by the waves from the northeast seas which swept past the outer shore.

In the year following, at the request of Señor Don Luis Molina, the minister from Nicaragua, the National Academy of Sciences examined the state of the harbor and reported through the Secretary of State to

the Senate. The chief conclusions reached by the committee of the Academy, General Humphreys, Captain (late Admiral) Davis, Prof. J. E. Hilgard (now Superintendent United States Coast Survey), and Prof. H. Mitchell of the same Institution, were: "The original bight of Greytown cannot be restored; the works necessary to arrest the drifting sand and those necessary to turn the lower San Juan, a larger supply of water, are costly. It will be necessary to maintain a sufficient anchorage by means of dredging." (Report of National Academy of Sciences for the year 1868, Senate Mis. Doc. 44, Fortieth Congress, first session.)

NAVAL SURVEYS.

Under the direction of Commodore D. Ammen, Chief of the Bureau of Navigation, Navy Department, new "tentative" surveys were made during the years 1870–'75 on the several lines of the isthmus. These embraced the survey already named under Captain Shufeldt, which was followed by those under Capt. T. O. Selfridge in Darien (supplementing his previous surveys of 1870), and by those across Nicaragua under Commander E. P. Lull in 1873, and by his explorations in Panama and those of Lieut. F. Collins on the Atrato in 1875.

The reports of the survey under Commander Lull in Nicaragua presented new and very interesting points in the canal question.

The line proposed would be 181 miles in length, of which the great lake of Nicaragua itself would furnish 56.50 miles; slack-water navigation of 63 miles would utilize the San Juan, and 61.75 miles of canal complete the route. The dimensions proposed were: Depth, 26 feet; width at the surface, 150 feet, at the bottom, 72 feet; the locks, twenty in number, 400 feet long and 70 feet wide, with a lift of 10.31 feet each.

Of the entrance to the canal at Greytown and its terminus at Brito, the report said:

> It has been determined by careful observations that the sand bank obstructing the entrance to the harbor of Greytown has been formed by the action of the sea striking the sandy beach at an angle. It is proposed to construct a breakwater or jetty that, acting as a trap, will intercept the sand moving along the coast from east to west. A channel will then be dredged, under the lea of the jetty, to obtain an entrance to the bay, the latter to be sufficiently deepened by dredging to satisfy the demands of traffic.
>
> At Brito a breakwater, a pier, and dredging will be required to build a harbor large enough to secure a smooth entrance to the canal, and accommodate a number of vessels. With the lake, only sixteen miles from the sea by the canal, possessing all the advantages of an excellent internal harbor capable of accommodating all the fleets of the world, the harbor of Brito need not be large.

The restoration of the two harbors was estimated to cost about $5,000,000; the cost of the whole work, $65,722,000.

As the result of three subsequent surveys made on the line by the engineer of Commander Lull's survey, Mr. A. G. Menocal, U. S. N., the length of the line has been reduced to 173.57 miles, and the estimated

cost of the whole to a sum (*not* including the usual allowance for contingencies) of $41,193,000.

The chief anticipated advantages offered by this route were stated to be its favorable geographical position, the facility afforded by the great lake, and the abundance of construction material; the comparative small rainfall, and relative healthfulness of the region.

The disadvantages reported are: The length, the requirement of locks, the want of harbors, and the location in a volcanic country.

The last of these objections is probably the least, and one of no serious moment. The friends of the canal show a reasonable expectation of being able to pass a ship of large dimensions through all the locks in three hours, and through the 173 miles in thirty-six hours.

Commander Lull concluded his original report by saying:

> The whole region of the isthmus has been thoroughly explored; I am fully persuaded that nowhere is there so favorable a combination of advantageous conditions as on the line through Nicaragua.

REPORT OF THE COMMISSION OF 1879.

In 1879 a commission appointed by President Grant, and consisting of General A. A. Humphreys, of the U. S. Corps of Engineers, the Superintendent of the U. S. Coast Survey, Mr. C. P. Patterson, and Commodore (now Admiral) Ammen, fully considered the reported surveys of the several proposed routes, including those latest made by Lull and Collins in Panama.

They reported that the Nicaragua route "possesses both for the construction and maintenance of a canal, greater advantages, and offers fewer difficulties from engineering, commercial, and economic points of view, than any other of the routes shown to be practicable by surveys sufficiently in detail to enable a judgment to be formed of their merits." The data for the conclusions of the committee were to be found in the reports made under the direction of the Navy Department. "If the work be conducted with ability and honesty, it can be completed within a moderate period of time, and at a cost that would prove commercially profitable."

The cost of construction, and of the harbors with all the necessary adjuncts, was set down as at least $100,000,000.

In this report, forwarded by President Hayes to the Senate April 18, 1879, and printed as Sen. Ex. Doc. No. 15, the Commission refer to reinspections of the Nicaragua and Atrato routes, made in 1874, at the request of the Secretary of the Navy, by Maj. W. McFarland, Capt. W. H. Heuer, U. S. Corps of Engineers; Prof. H. Mitchell, U. S. Coast Survey; and General Jacob Ammen, and D. S. Walton, C. E.: "whose services were not the less valued and appreciated because they were honorary." The reports of Major McFarland, General Ammen, and Professor Mitchell were sent to the Senate with that from the Commission.

Of these none were printed by Congress. Professor Mitchell's will be found in the Coast Survey Report of 1874. Major McFarland, a copy of whose report is at hand, states "that the most serious question to be encountered was the problem of the formation of suitable harbors at the extremities of the route, that of Brito being called by courtesy a harbor, but possessing none of the characteristics of one, and that of San Juan being incapable of restoration." The plan proposed for one at Brito he considered entirely inadequate to the wants of a great canal such as would answer all the purposes of commerce. The cost of such he placed at $4,500,000.

The proposed plan for restoring the harbor of Greytown he considered also to be ineffectual, because "the sands already deposited are so great in volume that under the movement produced by the northeast winds and seas which here prevail, they would speedily choke up and destroy any harbor constructed to the westward of the mouth of Tauro Pass, unless thrown well out into the sea."

The difficulties in the way of accomplishing the desired object by the means indicated, were reported to be,—

"First. The impossibility of dredging in an open sea, where, although there may be no gales, there is a constant ocean swell sufficient to prevent the use of any dredge whose usefulness up to the present time has been successfully and certainly established. A swell of 2 feet is sufficient to prevent the dredge from working, and any swell increases the cost. The construction of a single pier would not produce the necessary stillness in the waters behind it.

"Second. The certainty that westward progression of the shore sands would speedily fill in the angle between the pier and the shore to windward, and the sands then working around the outer end of the pier would hug it and would soon close any channel that might have been constructed inside of it.

"Third. The uncertainty of our being able to close the upper opening of the San Juan Branch. The material of this whole delta foundation is soft, and floods even now rise above the banks.

"The Colorado branch cannot receive and discharge more than it now receives and discharges without changing its regimen, and to attempt to compel it to receive the waters which now flow through the Lower San Juan by shutting them off from their natural course by the construction of a dam across its head, would be simply to test the relative resisting power of the bed and banks of the Colorado on the one hand, and of the artificial obstruction on the other; a trial in which, in this soft material, the chances would be altogether against the artificial work, around the ends of and under which the obstructed waters would almost certainly make their way.

"The harbor at Greytown is, in my opinion, irretrievably ruined, and the only question relating to it which remains to be determined is

whether an artificial harbor can be formed which may be expected to be permanently valuable for canal purposes.

"I believe this can be done, but in one way only, and that is by carrying the canal boldly out through the harbor of Greytown and into the sea into thirty feet of water; and by constructing outside of it, and at a convenient distance from its extremity, a detached breakwater so situated as to form a deep-water harbor behind it, and to give to the entrance of the canal a sufficient protection from the waves. The estimated cost of this is $9,500,000; for both harbors, $14,500,000."

The Commission of 1879, referring to this report, and to the others which have been named as made by invitation of the Department, say:

> Whatever differences may exist between the reports of Engineer Menocal and those of the gentlemen referred to, it is conceded that the surveys are sufficient to make an approximate estimate of the amount and character of the work. The questions of the enlargement deemed necessary by Major McFarland, the construction of more extensive harbors, the relative cost of labor and material there as compared with the rates of our country, as well as the location possible, will doubtless engage the careful attention of those engaged in the construction of the canal.

The differences between the estimates for the canal made by the engineer of the survey of Commander Lull (modified afterward, as has been stated, by two subsequent examinations by the same engineer) and those given by Major McFarland, are wide; those given by Mr. Menocal being as low as $41,193,000, without allowances for contingencies, and the estimates of Major McFarland being, in full, $140,000,000. To this difference, probably, the Commission referred in the paragraph on this point which has been cited, in placing their own estimate as "at least at $100,000,000." If, however, a canal be practicable on this line sufficient to meet the demands of the commerce of the day, the question of this difference in cost will be an element of small importance.

In this connection, the time required for the passage of ships through locks is an element largely determining the problem. The experience of the Suez Canal, which passes its vessels in about eighteen hours of under way, is to be noted in connection with the complaints of shippers of delay. The transit is delayed by the rule forbidding the passing of any one ship under way by a second.

The total time estimated as necessary for passing through the locks of the Nicaragua Canal is three hours, and through the whole line thirty-six hours. M. Fontane, the secretary of the Suez Canal Company, affirms that, from the experience of the Suez route, an annual traffic of 6,000,000 tons (the lowest estimate for a source of profitable returns from a ship canal) cannot be realized unless it is practicable for fifty ships to pass in a day, and this for several successive days. M. Dirks, the engineer of the Amsterdam Canal, states that "one hour is necessary for the passage of a ship in either direction through a lock of that canal, fifteen ships only being thus to be counted upon in a day of fifteen hours. When two locks are combined, as the North Sea locks at

the port of Ymuiden, where the lockage is to the sea, twenty-five ships have passed between the hours of 11 a. m. and 8 p. m."*

In the Coast Survey Report of 1874 (Appendix No. 12) will be found the report of Professor Mitchell in full. After sketching the steps of the decay of the once fine harbor of Greytown—the subject, as has been seen, of the report of the committee of the Academy of Sciences of 1866—he speaks of the chief points in the problem for a canal here as follows:

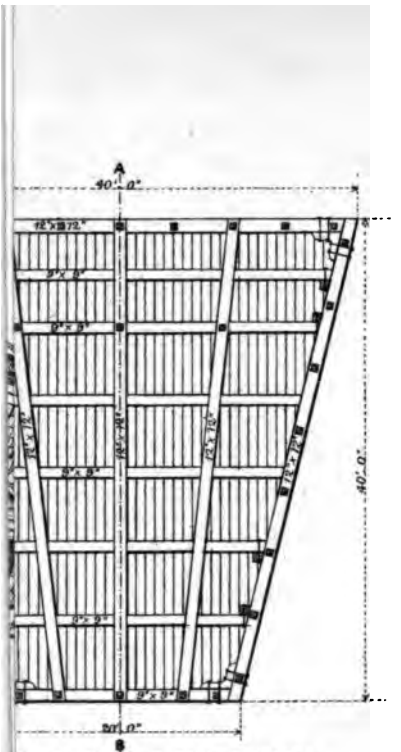
The once grand entrance of Greytown could not have been maintained by the San Juan, even if it had been the only avenue of discharge from the main artery. One has only to divide the discharge (measured by any of the engineers) into the cross-sections of the ship-channel given upon the old charts, to discover how powerless the seaward flow must have been. From the best computation that I can make with the data at hand, I find that in 1832 the section of the entrance to Greytown was *seventy times* the area that we have now in the Lower San Juan at the head of the passes; *eighteen times* the section of the main river above the Colorado in dry seasons; and *seven times* the sections of the main river in "top-gallant floods." Even as late as 1853 the section at the entrance to Greytown Harbor was five times as great as that of the main river. * * *

A jetty designed to arrest the traveling sands of the coast most effectually, should extend in a direction nearly normal to the shore, and yet have a tendency to turn the sea slightly shoreward, so as to prevent the sands from escaping by the *race* round the end of the pier. The jetty plotted upon the map sent to me answers these tests pretty well. A position has been chosen where a line at right angles to the general shore-line (which trends southwest in this neighborhood) is slightly inclined toward the direction of the sea, which, although created by the northeast trade-wind, is

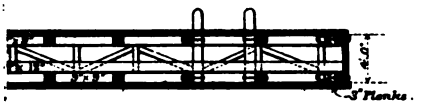
* The Zuider Zee locks consist of three locks, one passage or large sluice-way, and three small sluice-ways. Situated in lake Y, they were built within a circular coffer-dam. The largest lock has length of 315 feet and is 60 feet wide. The other two locks, one on each side, have each a length of 238 feet and are 47 feet wide. The large sluice-way is 34 feet wide, and the three small sluice-ways are each 110 feet long and 13 feet wide. The three locks have each five pairs of gates, two pairs, pointing in opposite directions, being placed at the ends of each lock, and one pair in the middle, pointing toward the Zuider Zee. The sluice-ways have each three pairs of gates—two pairs pointing towards the Zuider Zee and one pair towards the canal. The Zuider Zee locks are on a larger scale than the North Sea locks, it being necessary to provide at the former not only for the traffic to and from the North Sea and the Zuider Zee, but also for that from Amsterdam to the ports on the Zuider Zee. The shipping of Amsterdam that would otherwise have been cut off, must get to the North Sea by the Texel Roads instead of through the canal; for, although the distance is great, yet the canal tolls are thereby saved. The locks are worked by crabs, there being one machine to every leaf for each operation. The gates of the pump-sluices are opened and closed by wooden levers.

The North Sea locks are two in number, and there is one passage or sluice-way. One of the locks is 390 feet long and 60 feet wide. The other lock is 227 feet long and 40 feet wide. Each lock is furnished with five pairs of gates, arranged as in the Zuider Zee locks. The sluice-way is 34 feet wide and has three pairs of gates.

The locks are built on sand, which rendered bearing-piles unnecessary, but the whole of the foundation of the sills and of the walls is inclosed in close sheet-piling. As in the Zuider Zee locks, the gates of the North Sea locks pointing towards the North Sea are of iron, and the gates pointing towards the canal are of red or American yellow pine, creosoted. The design is the same in both places.—(Hayter on the Amsterdam Canal.)



AL PLAN OF RADIAL LIGHTER.



SECTION THROUGH A.B.

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modified in the direction of its onset as it approaches the coast, so as to strike at a less angle than it would if driven directly before the wind. * * *

The jetty, as plotted, 3,000 feet long, will shelter nine ships under its lee, as the bottom now lies, and double this number if dredging is done within a reasonable distance of the beach and the entrance. These estimates are based upon the consideration that the wind is nearly constant, so that vessels may be expected to swing together over an octant of 500 feet radius, and that the least depth of water required will be 18 feet. * * *

As adjuncts to the jetty proposed, other works will be necessary to arm the beach against the attacks of the sea and give firmness to the abutment.

Should an experiment show that there is no reasonable hope of turning the Lower San Juan into the Colorado by a more rapid process than nature seems to be attempting, a dam from the jetty to the Greytown shore is proposed as an alternative plan for excluding the river *débris* from the Greytown basin, and incidentally serving other purposes.

OF BRITO.

This is not a harbor, nor even a roadstead, in the strict sense of the word, since there is no shelter from seaward, and the belt of holding-ground along the coast is so narrow that, in heavy weather from the northward, no vessel would venture to seek this anchorage.

Conclusions relative to Brito.—With little to recommend the locality as a site for the construction of a harbor, Brito presents no difficulties unfamiliar to engineers.

The harbor proposed does not promise sufficient protection from the sea, is not of the most approved form, and is too small. Making due allowance for a central "gangway" for vessels going to and from the canal, we find room for not more than a dozen ships riding at anchor, allowing each ship four points of swing-room over a radius of 500 feet.

It is suggested that a double harbor will be found necessary in order to secure tranquillity in the receiving-basin near the entrance of the canal; and the office of the breakwater should simply be to shelter the approach to the necessarily narrow entrance of this inner port. * * *

[If, in the foregoing remarks upon Greytown and Brito, I have confined myself too exclusively to the *difficulties* presented, it is because I not only felt required by my instructions to observe them, but my attention was particularly called to them by the ingenuous commander and the able engineer of the Nicaragua Ship-canal Survey, who acted as our guides.]

The report made by General Ammen (formerly U. S. A.) has not been found accessible. In a letter to the Committee on Foreign Affairs of the House of Representatives, dated April 15, 1882, he said of his inspection of this line in 1874:

Regarding the whole route from ocean to ocean, on a careful examination, aided by the surveys in passing along, I was struck with the ease and facility of execution, there being not one engineering difficulty, unless it be at the harbor of Greytown, which in itself, as compared with many harbors that have been made, imposes little relative difficulty of construction and maintenance. When at that point, without any previous discussion of the subject with the engineer, I defined the locality that I would select for operations, which fully coincided with his own. * * *

No report from Civil Engineer Walton, noted in the report of the Commission of 1879 as being received, has been printed, or has been found accessible for this paper.

THE PANAMA ROUTE.

M. Garella's survey made here for a ship-canal in 1843 followed the valleys of the Bernardino and Camito on the southern descent and those

of Quebrado and Chagres on the northern. The mountainous region approaches very near the Pacific, and its highest elevation is 459 feet above the level of the sea. He tunneled the mountain at about 99 meters (324 feet 9 inches) below its highest point, and established his summit-level for a distance of 25,361 feet at an elevation of 135 feet above high water from the Pacific Ocean. From this summit-level he descended to the Pacific Ocean by means of seventeen locks, some of which were necessarily very much crowded. On the other side he descended to the Atlantic by eighteen locks, which, owing to the more gradual descent on the north, were more conveniently spaced. Of the whole length of the summit-level 17,550 feet were subterranean. This is not only inconvenient to vessels, but involves great expense, since the tunnel must be sufficiently high to allow vessels to pass through with their lower masts, at least, standing. The plan was for ships of only 600 tons burden.

In 1857 the late Mr. G. M. Totten, the engineer of the Panama Railroad, proposed a canal from 5 fathoms in Navy Bay to 3 fathoms in Panama Bay, 48¾ miles; the prism of water to be 150 feet wide at the bottom, 270 feet at surface, and 31 feet deep, the locks to be 400 feet in the clear length of chambers, and 30 feet in clear width; the summit-level would be 150 feet above mean tide of the oceans; the deepest cut would be 136 feet, and the average depth of the cut 49 feet. It was to be supplied by a feeder 24 miles in length, which would tap the Chagres River 21 miles above Cruces. The cost of the work he estimated not to exceed $80,000,000, including the requisite improvements at each end.

Under the Navy Department, in the year 1874, Commander Lull made a reconnoissance for a canal line in the vicinity of the Panama Railroad. He reported the practicability of a route 41.7 miles long, with a summit-level 123.7 feet, to be overcome by twenty-four locks having a lift of 10 feet each; also a tidal lock at Panama. The estimated cost was $94,511,000. The Commission of 1879 reported as grave objections to this route its liability to floods, and the excavation of the deep cut. The cost they estimated would be double that of the Nicaragua route.

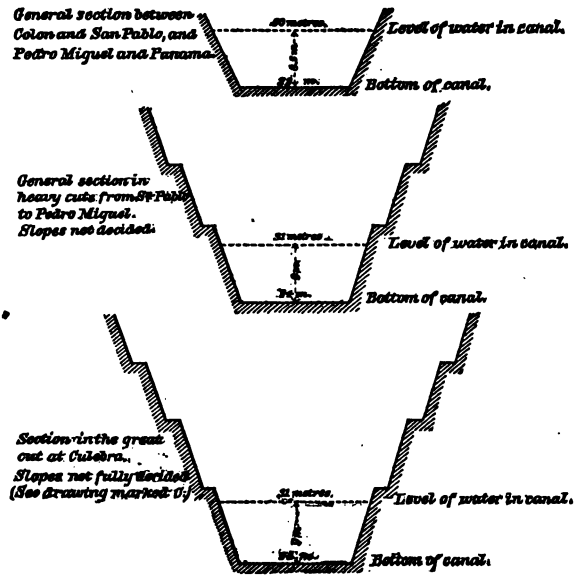
THE CANAL BEGUN IN PANAMA IN 1881.

The reports from Admiral Cooper and Lieutenant Rodgers to the Navy Department (Senate Ex. Doc. 123) detail the progress of this canal now being constructed by the company under M. de Lesseps with sufficient fullness to aid in forming a fair judgment of the work.

The canal is designed to be without lockage, *à-niveau*, except a tide-lock near Panama. Its dimensions are: length, 73 kilometers; breadth at water line, 28 to 50 meters; depth of water, 8.5 to 9 meters; curves at no place less than with a radius of 2,000 meters.

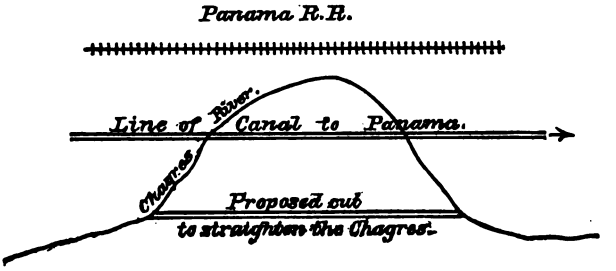
LINE OF THE CANAL.

The general direction is that of the Panama Railroad, from which it diverges not more than a half a mile until it reaches the neighborhood of Panama, the divergences necessitating at some points deeper cuts than those for the road, to permit the 2,000 radii curves. The sections of the canal are shown by the cuts.


General section between Colon and San Pablo, and Pedro Miguel and Panama.
Level of water in canal.
Bottom of canal.
General section in heavy cuts from St. Paul's to Pedro Miguel. Slopes not decided.
Level of water in canal.
Bottom of canal.
Section in the great cut at Culebra. Slopes not fully decided (See drawing marked D.)
Level of water in canal.
Bottom of canal.

No. 1.

The plan involves, among other essential points, the building of a water-course on each side to separate from the canal the waters of the Chagres and its tributaries and carry them to the sea; the straightening of the river at several points, that the canal may escape the enormous and sudden rises in it, the course of the Chagres being made more direct; and the construction of a large dam to restrain the waters of the Upper Chagres. The annexed cut shows the plan of the straightening at Gatun:



No. 2.

Of the general plan of the work Rodgers says:

The uniform slope of 1–1 has been fixed upon for the sides of the canal, except in the rocky sections, where the slopes will be more abrupt, and in the lower and swampy lands, where they will be less inclined. It is the present intention to ballast the sides of the canal below the water-level; to have a banquette a few feet above this level to afford a passage-way, and to revet the upper slopes with vegetation, which in this region spreads and grows with remarkable rapidity, and which it is thought will amply protect them from washing.

The ports of Colon and Panama will be sufficiently large to accommodate a great number of vessels. The central station will permit vessels to pass each other readily, and the tidal dock at Panama will secure a uniform level in the canal and prevent inconvenient currents which might arise from the inequalities of the tides of the two oceans.

After passing the 59th kilometer the width of the canal increases to 200 meters and the tidal dock or basin of Panama is entered. This dock extends to the 65th kilometer, where the tide-gates are to be placed. At this point the dock is to have a width of 600 meters. It is intended to make this tidal dock sufficiently large to accommodate not only the vessels about to pass through the canal, but also those to be discharged at Panama.

At the 68th kilometer the canal will enter the Pacific, and from this point will be carried by dredging to the 74th kilometer, where sufficiently deep water is found in Panama Bay.

THE GEOLOGICAL FORMATIONS.

Admiral Cooper gives the soundings along the line as indicating the following varieties of soil:

From Aspinwall to Tiger Hill the route runs through alluvial soil, with occasional patches of volcanic tufa; from Tiger Hill to San Pablo conglomerate soil and clays are found; between San Pablo and Matachin is the alluvial formation of the Chagres, and along this section the level of the district is only about 80 feet above the level of the sea. At Matachin solid rock of the hardest kind is found, and this is the most difficult part of the canal. Beyond this comes clayey tufa overlying the dolerite of the Serro Culebra. From Matachin to Culebra the cuttings will be very deep, and at Culebra, the highest point, the depth is more than 300 feet. From Culebra to Panama the route runs through solid pyroxenic rock and sandstone tufa.

THE DAM TO RESTRAIN THE CHAGRES.

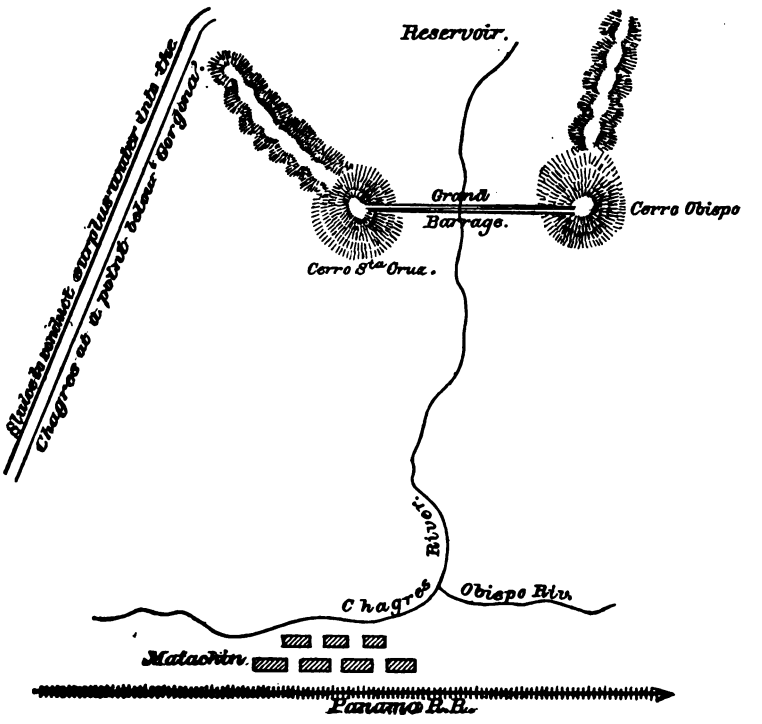
The Chagres turns sharply to the eastward at Matachin, between the forty-fourth and forty-fifth kilometers, passing between the Cerro Obispo and Cerro Santa Cruz at Gamboa, where the dam or *barrage* is to be built, distance about a kilometer from the canal.

Behind this great dam, 1,000 meters long and from twenty-five to thirty meters high, the headwaters of the Chagres are to be restrained in an immense reservoir within the neighboring hills. The surplus water is to be drained from this reservoir and controlled by means of a sluice, which will empty into the Chagres between the forty-third and forty-fourth kilometers just below Matachin.

From this point on to the sea, as has been before mentioned, these waters of the Chagres south of the seventeenth kilometer are to be kept to the eastward of the canal by means of sluices and deflections of the stream, thus finding their exit in the Boca Grande to the southward and eastward of Manzanilla Island, upon which Aspinwall is built.

A study of the general plan of the section of Gorgona will point out the position of several miles of sluice to the westward of the canal, which is to carry off the waters of the Obispo and of the smaller tributaries of the Chagres found on that side of the valley.

Some preliminary work has been done in the neighborhood of the dam, but nothing of importance. It is probable that some time will elapse when more railways will be



No. 3.

laid to its site from the neighboring sections, before any serious work will be done here. The preparations for this work must be very complete, for once begun, it must be quickly finished on account of the rapid accumulations of water during a rainy season or even of a rainy day.

THE GREAT CUT OF CULEBRA.

The cut between the highest points here will be about 300 meters wide, and for a short distance from 150 to 160 meters deep. The height of the summit of the canal axis is 101 meters above the sea-level.

The American steam excavators (Osgood & McNaughton) in use here are said to work very satisfactorily, to need but little repairs, and to have a capacity for digging in the soil of the summit from 60 to 80 meters per hour.

The work is now being pushed with some activity, and about 2,000 cubic meters are removed each day. Twenty-eight thousand meters in December and 60,000 in January in 1884 show the increased result of the work of excavation. It is hoped that another month may produce the amount of 100,000 cubic meters. When it is remembered that there are some 25,000,000 million cubic meters to be removed from this section of 2 kilometers length, an idea of the date of completion may be roughly formed.

It is but just to state in this regard that the dumping grounds near at hand are quite sufficient; that the railways are prepared, and the great width of this cut will enable the attacks to be made at many different points; and it is not improbable that in a short time from 200,000 to 300,000 cubic meters per month may be readily excavated. The cost of excavation at present varies from 75 cents to $1.50 to $2 (silver) per cubic meter.

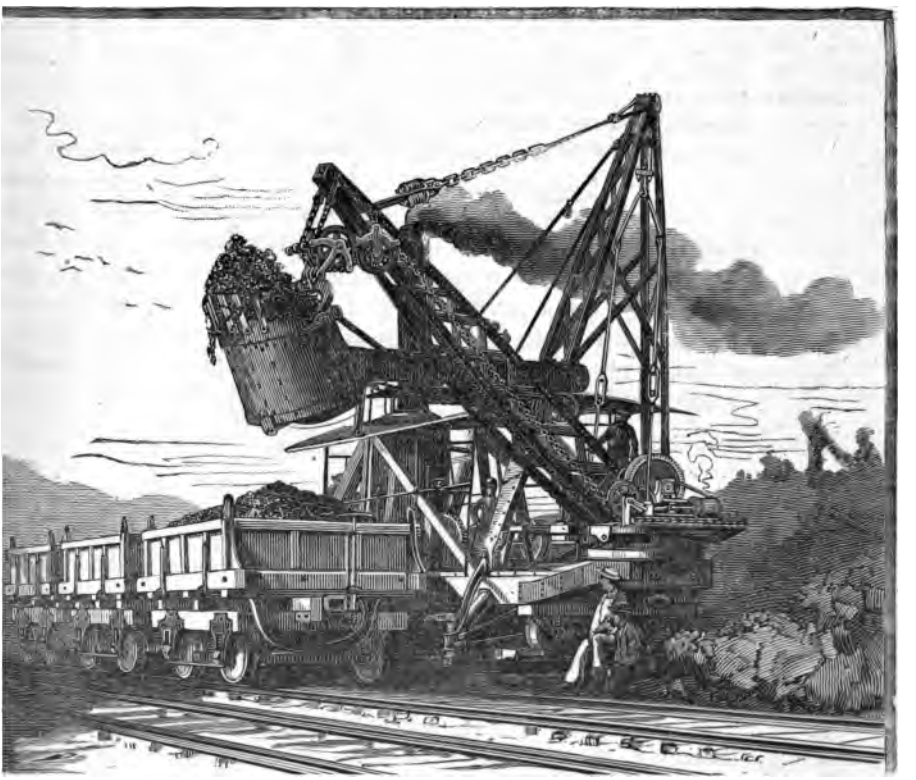
At present there are employed 1,500 laborers, two locomotives, with trains, several hundred hand-cars, and four Osgood & McNaughton (New York) steam excavators. There are 4 more of these American machines ready for work, though not used, owing to the want of dirt-cars and locomotives.

In this connection it is certainly most gratifying to note the admission that our American machinery surpasses even the excellent manufacture of the French. Admiral Cooper says that in the matter of soundings "the American diamond drill had done more work in three months than had been secured by the old methods in the two previous years"; the heaviest cutting on the Culebra is in the hands of Americans. Since October, says Rodgers, the dredge of the New York company has dug a passage from Colon 1,075 meters long, enabling vessels to pass up the canal a half mile. Machinery and material are largely American. According to a report from an officer on the isthmus, dated May 12, 1883, "a steam dredge 160 feet in length, of 250 horse-power, and costing $140,000, built at Petty's Island, N. J., was, at that date, at work on the entrance of the canal. This dredge is of 440 tons; it is so constructed as to lift up to a height of 80 feet from the bed of the canal, stone and earth and then drop the material to form the sides of the canal."

THE WORK DONE IN 1882.

In 1883 Admiral Cooper said that, although no great amount had been done on the canal itself, all the preliminary surveys and soundings had been made, the route had been almost entirely cleared of its tropical growth by the Puerto Belo Indians, large quantities of supplies provided, cottages and barracks for the employés erected in healthy elevated localities, hospitals established; and, in his opinion, such liberal provision had been made for all possible emergencies that this careful preparation for the great undertaking strengthened his belief that the canal will be ultimately finished. As to the possibility of this result at the time estimated (1888), he says:

The whole undertaking is so gigantic that one cannot believe that it will soon be finished; but I am impressed with the fact that the French are thoroughly in earnest, and that if they fail to finish the canal on account of want of funds the work done by them will be well done, and will be so extensive as to always give this route great advantages over any other. After all, the completion of the canal is a question of money, for the undertaking offers no insuperable engineering difficulties; but the enormous cost, which can hardly be estimated, and the long time which an investor in the enterprise must wait for returns upon his money, may deter capitalists from taking the stock, and thus the company may be crippled and the work brought to a close. The lowest estimated cost of the canal is $120,000,000, and to pay the expenses of working the canal and a reasonable dividend to investors the amount received for tolls per annum should be at least 10 per cent. of the cost, or about $1,000,000 per month. The



American Excavator at work at Culebra.

cost of the canal will probably be much more than the above estimate, and it does not seem probable that there will be commerce enough passing to and from the Pacific ports by way of the canal to pay this enormous sum, at least in the near future. One fact, however, is certain, that even if the present canal company fails, still, if the canal is ever completed along this route, the credit of the design of the enterprise and of its energetic commencement will always be accorded to M. de Lesseps.

HEALTH OF THE EMPLOYÉS.

Writing from Aspinwall, he said:

The general impression has been that as soon as the work of excavation was commenced fever would become epidemic, and that this sickness would form a great obstacle to its progress. Of course no one can foretell the result upon the general health which would be caused when the excavators turn up to the sunlight the depths of the isthmus swamps, but I believe that the trouble from this source will be less serious than has been anticipated. Although there has been some sickness there has been no epidemic, and should one unfortunately occur, the hospitals which have been erected in the healthiest situations will be of the greatest service.

OUTLOOK FOR COMPLETION.

Lieutenant Rodgers says, in his second report of January 27, 1884:

The number of men now employed in all sections is probably at least 15,000, brought chiefly from Jamaica and Carthagena, and the amount of excavation has gradually increased until 700,000 cubic meters per month have been reached. It is hoped that the month of February will produce 1,000,000 cubic meters, and that later the amount of 2,500,000 meters will be removed each month. The rainy season begins in May and continues till December, and it is estimated that the rains will reduce the excavation of the dry season by about one-fifth, so that it is not unlikely that from the 1st of May next an annual excavation of 25,000,000 cubic meters may be counted upon. And this leads to a consideration of the date of completion of the works.

The year 1888 has been announced by M. de Lesseps for the opening of the canal. It is not impossible, with the requisite money, that the sections of the canal, exclusive of those of Obispo, Empire, Culebra, and Paraiso, may be ready for service within the time specified; but it does not seem possible that these most formidable sections, with their cuts of great depth and width, can be made ready, nor that the ports at the extremities can be completed for some years later. Consider the section of Culebra, with its great excavation of more than twenty-five millions of cubic meters, and suppose that the large amount of 300,000 cubic meters be removed each month from it. At this rate it would take seven years to complete this section.

It is impossible for me to know the financial condition of the company; but from more than one source I infer that about $40,000,000 have thus far been expended (not including the cost of the Panama Railway).

There is an immense amount of machinery and material now on hand or contracted for, and it is probable that there remain sufficient funds from the amount already subscribed to meet promptly the current expenses for two years to come.

After that, with the enterprise well begun and with a fair proportion of the whole excavation already removed, it would seem plausible that the prestige of M. de Lesseps's name and the confidence which the investors of France have in his ability to carry through successfully this great work would procure the further necessary subscriptions. Whether the estimated sum—600,000,000 francs—will prove sufficient, time alone can decide; but as one-third of this amount has already been expended, it would seem insufficient to complete this most formidable undertaking. * * * * * * *

It appears to me that the question whether this is or is not a better route than that of Nicaragua has almost passed from the problem of interoceanic communication.

The work here has been fairly begun; large quantities of machinery and material for transportation have been collected and are now upon the Isthmus, and unless some government should undertake a similar project at another point it does not seem probable that any private capital, available for such an enterprise, would lose the benefits of the detailed studies, the work already done, and the money already expended upon the route of the Panama Canal.

The climate has thus far not proved so fatal in most of the sections as might have been anticipated. Of course, exposure to the sun, heat, and fatigue have produced fevers and have occasioned mortality; but as a rule the employés of the company seem in fair health, and the Europeans have suffered more than the laborers, natives of the tropics. But, while most of the sections have not been very sickly, the neighborhood of Panama has proved an exception to the general rule. Here during the past six months have appeared, in larger numbers than usual, pernicious fevers, and there have been several cases of yellow fever which have proved fatal."

THE RAINFALL.

The rainfall for the year 1883 was as follows:

Name of place.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	Total.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
Colon	2.83	23.64	52.50	37.00	118.02
Gamboa	.....	19.83	27.97	23.20	71.00
Island of Naos, Panama	0.59	9.45	15.18	11.40	36.62

The greatest monthly rainfall was 25.51 inches in August, at Colon.

In a report received at the Navy Department in July of the present year, Lieut. R. G. M. Brown says:

While, no doubt, much engineering work has been accomplished, as the work progresses new engineering problems will arise, as much of that done is theoretical rather than practical. Nobody can safely predict that the proposed method of controlling the Chagres River will be satisfactory. The problem where to put the 60,000,000 cubic meters of earth from the hilly sections is a difficult one.

MATERIAL ON HAND.

In regard to the material on hand some difference of opinion exists. The friends of the company claim that $15,000,000 was expended for material. Others say that all of it was bought at extravagant prices; that much of it was unsuitable—notably a large number of Couvreux excavators, which, while suitable for the Suez sand, are unable to excavate the earth and rock of the isthmus. I was informed by an intelligent person that material costing nearly a half a million of dollars had been allowed to sink into the soft marsh and was finally covered up. It is even said that some of the material has already been condemned and sold to vessels leaving Colon for ballast.

Forty-one hospitals have been constructed, costing over $3,000,000, and accommodating about four hundred patients, but their capacity will have to be increased if the work is vigorously prosecuted. The most serious obstacle to the completion of the canal is the Chagres River.

The plant reported at the annual meeting of the stockholders July 23, 1884, foots up largely. Including what had not already arrived on the isthmus, it embraced 240 locomotives, a sea-working dredger, 43 inland dredgers, and 99 excavateurs of a large type; other appliances seem-

ingly making up all that can possibly be needed toward the furtherance of the plans, even to that of a supply of lights for the carrying on of work by night. The cost of the machinery yet to be put in operation is about $7,000,000. The force employed in May, 1884, is reported at 19,000 men.

It is evident that the two serious obstacles on this line are the control of the rises of the Chagres, and the depth of the cut in the Culebra section. In regard to the first of these M. Lesseps has said that—

Although the dam will be a large one, costing 95,000,000 francs, and regulating the waters of the Chagres, the Obispo, and the Trinidad, it will be perfectly safe. There are three resorvoirs that contain more water than it will, and they have stood time out of mind. There is the great dam at St. Etienne, France; the one at La Gillappe, Belgium, and the one at Alicante, Spain, which have stood three centuries, and are as good to-day and as strong as they ever were. The Chagres dam will stand longer. The three just mentioned, are from 40 to 50 meters high—140 to 160 feet. Science has improved since the days that the great retaining walls of Alicante were erected. It will do justice in this canal—to this age of progress, in which it is the greatest factor.

Of the rise in the Chagres it is reported by an officer on the isthmus:

The greatest rise known took place in December, 1878. It was seven meters (23 feet) above its usual line, the sections of that part of the river attaining 800 square meters, its total volume being calculated to be equal to 207,000,000 meters. These exceptional rises, which last 24 hours, are calculated to produce 112,000,000 cubic meters on the same surface. The greatest rainfall ever observed and noted was 80 centimes (31.5 inches) per month, which would give 720,000,000 cubic meters of water. Calculating that the reservoir will discharge 100 cubic meters per second, it would empty 259,000,000 cubic meters per month, to which must be added evaporation and absorption, say 11,000,000 meters, which would make 270,000,000. The capacity of the dam being 666,000,000, the greatest rise would never overflow or even fill it.

Ten miles above will be a second dam to restrain the violence of the first rush to the main reservoir.

In regard to the great cut of the Culebra: At the close of the reports from Admiral Cooper and Lieutenant Rodgers will be found "an Addendum," in which Lieutenant Rodgers says—

The greatest height (above the sea level) of the *axis* of the canal is 101 meters, but on account of the great *depth* of this cut, the *slopes* of its sides, and the nature of the soil, the hills on either side of the axis must be partially removed. Hence the statement that for a short distance (some few hundred meters) the sides of this cut are considerably more than 101 meters in height. The highest point on the eastern side of the Culebra cut is between 150 and 160 meters above the sea-level; but this height is maintained for a few hundred *feet* only.

The notice of these recent operations has been here made full because they are in active progress, with representations of assured success. The plans were indorsed by MM. Dirks and Conrad, the two most eminent engineers of Holland, and by the late G. M. Totten, who built the Panama Railroad. The programme presented July 23, 1884, for the completion of the canal, retains the dimensions which have been named, the width of the bed of the canal to be 22 meters, the depth 9 meters, and the tide-lock at Panama to be so constructed as to give uninter-

rupted communication with the Pacific and regulate the tide and local currents.

The expectation of final success in 1888 is based on the extraction during the first four months of 1884 of as many cubic meters of earth and rock as had been in all excavated within the two previous years. The expenses of the construction to the date of July 1, 1883, were reported at 211,029,777 francs, of which the purchase of shares of the Panama Railroad and of machinery and materials footed over 100,000,000 francs; leaving for the cost of construction proper about 100,000,000 francs, or 20,000,000 thus expended: July 23, 1884, from the loans made by the stockholders, a reserve was reported as in hand, 129,000,000 francs.

It should be noted in the history of this work that, in accordance with the 4th article of the concession from the Colombian Government, the grant of 500,000 hectares (1,335,000 acres) of land *domaniales* has now been awarded, upon the recognition by the Government of the completion of more than one-third of the work.

IN REGARD TO THE SAN BLAS ROUTE,

so energetically prosecuted by Mr. F. M. Kelley's engineers, it must be said that, although it would be the shortest line of all the proposed routes, the distance from the Atlantic to the Pacific tide being only 19.5 miles, and although the harbors at both termini are exceptionally good, it must be eliminated from the problem of canalization by its demand for a tunnel of from 7 to 8 miles.

THE ATRATO NAPIPI ROUTE,

fully surveyed by the expeditions under Commander Selfridge and Lieutenant Collins, which supplemented the extensive surveys of Michler, Craven, and Trautwine, in the same region, must also be eliminated, by reason chiefly of a like demand for a tunnel. The commission of 1879 additionally speak of the special difficulty in furnishing laborers and their supplies for this route; of the excess of its rainfall over that of all others; of its estimated cost of 50 per cent. over that by the Nicaragua line, and of the excessive cost of maintenance if constructed. A canal route by way of the Atrato was found by Lieutenants Craven and Michler to be impracticable. Lieutenant Craven's report, made February 15, 1859, will be found as House Ex. Doc. No. 63, Forty-sixth Congress, second session. It had slept twenty-one years in the archives of Congress. In a letter received from the late Mr. Trautwine, C. E., from considerations like those named in Lieutenant Craven's report, he estimates the cost of a canal via the Atrato at from $300,000,000 to $400,000,000.

LIST OF NAVAL SURVEYS.

The preceding summary of the surveys and reconnoissances on the *isthmus* has referred to the chief of these only.

The following enumeration of all the lines and of the work done upon them is taken from Admiral Ammen's exhaustive discussion entitled "The American Interoceanic Ship-Canal Question," 1880.

I. Instrumental reconnoissance of the Isthmus of Tehuantepec, by Capt. R. W. Shufeldt, U. S. N., 1872.

II. Examination, survey, and definite instrumental location of an interoceanic canal route from the vicinity of *Greytown via Lake Nicaragua*, and thence via the Rios del Medio and Grande to Brito, by Commander E. P. Lull, U. S. N., 1872 and 1873; with some preliminary operations by Commander Chester Hatfield, U. S. N., in 1872.

III. Examination, survey, and definite instrumental locations of an interoceanic canal route from Navy Bay to Panama, by Commander E. P. Lull, U. S. N., 1875.

IV. Examination and surveys from the *Gulf of San Blas* towards the river Chepo, by Commander T. O. Selfridge, U. S. N., 1870; and reconnoissances from the waters of the Chepo toward the Gulf of San Blas, by Commander E. P. Lull, U. S. N., 1875.

V. Several tentative instrumental lines in the vicinity of Caledonia Bay, across the Cordilleras to the waters of Sucubti and Morti rivers, tributaries to the Chucunaque, by parties under the direction of Commander T. O. Selfridge, U. S. N., 1871.

VI. A barometrical reconnoissance of the so-called "*De Puydt route*" by way of the Tanela River between the Tuyra and the Atrato, by a party under the direction of Commander T. O. Selfridge, U. S. N., 1871.

VII. Tentative instrumental lines by the so-called "*Gorgoza route*" from the eastern coast via the *Atrato*, *Cacarica*, and Peranchita rivers, and from the west coasts via the Tuyra and Cué rivers across the "divide," by parties under the direction of Commander T. O. Selfridge, U. S. N., 1871.

VIII. An instrumental examination of what is known as the "Truando route," by Lieutenants Michler, U. S. A., and Craven, U. S. N., 1856–1857. An instrumental reconnoissance of the Napipi and Cuia rivers, including a reconnoissance of the Atrato River to the town of Quibdo by parties, under the direction of Commander T. O. Selfridge, U. S. N., 1871 and 1873.

IX. Tentative examinations and definite instrumental location of an interoceanic canal route by way of the Napipi and Doguado rivers, by Lieut. Frederick Collins, U. S. N., 1875.

RECAPITULATION OF RESULTS.

I. The Tehuantepec route, possessing large natural and political advantages, requires 140 locks to overcome a summit level of 754 feet and a feeder 27 miles in length. Its cost would largely exceed that for Nicaragua.

II. The Nicaragua route has the lake of 2,800 superficial miles as a grand interior basin as well as feeder, a more healthful country, and more abundant supplies for a construction force than any other route. The unfortunate character of its harbors and the requirement of locks have been noted.

III. The Panama line is the shortest of all the routes not involving a tunnel. It is liable to the heaviest of the tropical floods, falling in the Culebra section upon a trench, for a short distance, nearly 500 feet in depth; it is also liable to the sudden rise of the Chagres. The provisions believed to be sufficient to overcome these obstacles are represented by the engineers of the "Interoceanic Canal" as entirely adequate. This expectancy as well as the character of the borings still to be made in the Culebra section await the test of time.

IV. The San Blas and other Darien and Atrato routes are eliminated from consideration by their requirements of a tunnel, as named above. The whole problem of canalization across the American isthmus thus reduces itself to a choice between the Nicaragua and Panama lines.

CONCLUSIONS.

The statements of this chapter have been designed to show the experience of the Suez Canal as instructive for a like work in our hemisphere, so far as like natural conditions exist here. The purpose has also been to endeavor to add to the considerations so forcibly and continuously urged by the Executive and by the Commission of 1879 in favor of prompt action towards the enterprise. The fairly anticipated results of such a work would, it is believed, far exceed those already secured at Suez. The natural obstacles to be encountered on our isthmus overbalanced by other considerations, would more readily succumb to the genius of engineering with its advanced appliances than did the coast line of Egypt and its drift sands to the machinery of 1864.

In an article to be found in the North American Review for February, 1881, General Grant forcibly says:

The states of North and South America lying along the Pacific furnish in large abundance those commodities, which are constantly supplied with markets in almost every country of Europe. Of guano and niter the trade is immense. From the ports of Chili nearly 400,000 tons of freight are shipped eastward annually. More than 1,000,000 tons of grain are shipped each year from the Pacific States and Territories. There is no doubt that more than 4,000,000 tons of merchandise find their way from these regions to the East, and require water communication in order that they may be shipped economically and profitably, and this is merchandise to which railway transportation across the continent is wholly inapplicable. The great wheat crops of California and Oregon, for instance, find their way to Liverpool around Cape Horn at the freight rate of fifty cents per bushel, a rate which would not carry it by rail half-way to Boston or New York or Philadelphia, to be there shipped to its European destination. In addition to the commerce of the North and South American ports referred to, there may be estimated also the advantages which would accrue to the trade of Australia and the remote East Indies bound to Great Britain, and which would undoubtedly add 1,000,000 tons to the freight seeking a passage through the canal. When we consider the time and distance saved by the canal for this vast amount of merchandise by avoiding the passage around Cape Horn, and the importance in these days of rapid transit and of a ready approach to a destined market, we can readily understand the value of the enterprise to producer and shipper and consumer alike. Leaving out of consideration the dangers and delays of the cape, we should not forget that by the canal now proposed the distance from New York to Hong-Kong is shortened 5,870 miles; from New York to Yokohama, 6,800 miles; from New York to San Francisco, 8,600 miles; from New York to Honolulu, 6,980 miles; from Liverpool to San Francisco, 6,065 miles, and from Liverpool to Callao, 4,374 miles; and we need no longer question the value of an interoceanic canal on the western continent, as we have long since abandoned all doubt of the value of the Suez Canal to the commerce of the nations of the east. To Europeans the benefits and advantages of the proposed canal are great; to the Americans they are incalculable. Forming, as a canal properly organized and constructed would, a part of the coast-line of the United States, it would increase our commercial facilities beyond calculation. Interfering in no way with the interests of those lines of railway which connect the

Atlantic States with the Pacific, but tending rather to stimulate and increase the activity out of which their traffic grows, it would cheapen all staple transportation, and add vastly to the ease and economy of emigration from the East to the farms and mines of the Pacific slope.

The American canal will take its place in history. Will Americans share in its construction? If the history of the enterprise in the Eastern Hemisphere furnishes, as is believed, solid basis for an expectation of equal or yet greater results from a canal here, why is it that no practical issue is made? In striking contrast with a seeming apathy to our own interests in this hemisphere is the proposition recently urged upon the English Government by the ship-owners of England to build a second canal across the Suez Isthmus *exclusively at their own outlay.*

The extension of our commerce with the countries named in the article just quoted, and the conveyance to them of a share in our own advanced civilization and in the blessings of civil and religious liberty, seem to demand that in the coming history of a canal a participation in it by America shall find place for record.

The prosecution of the enterprise on any line may involve political questions into which it is not within the province of this paper to enter; but if an impartial judgment may at its close be permitted, it finds its expression in the suggestion that a Mixed Commission of Army and Naval engineers be called upon to examine the *present* engineering facts of the problem. The advance of the work on the Panama line reported by the Naval officers named in this chapter is confirmed by the testimony of several other officers resident on the Isthmus or crossing it. The time, it is believed, has come when a choice should be made between the commencement of work on a separate line and a participation by capitalists in the one now under way.* A proper decision of such a question can be based only upon the unbiased judgment of engineers, who will consider all the facts of each case as they now exist. If the Commission now suggested should visit the two lines, the Nicaragua and the Panama, in company with a Committee of Congress, important results it is believed must ensue.

* Without advice in regard to the political issues involved and which lie within the promise of the Executive only, it were presumptuous to suggest a participation by the Government in the enterprise now being pushed on the Panama Isthmus. As, however, it seems that Congress will not undertake a separate work, reference will be permitted here to the controlling interest in the Suez Canal (and by consequence over English interests on the Isthmus and in Egypt), which, together with large pecuniary gain, England has acquired by her purchase of shares named on pages 14, 98.

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II. Message of President of the United States, in relation to Central America, 1850. The Clayton-Bulwer treaty.

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Maritime Canal Company of Nicaragua:

Amendments to proposed charter. February 12, 1881. (House report 211, Forty-sixth Congress, third session.) p. 1.

Favorable report. April 4, 1882. (Senate report 368, Forty-seventh Congress, first session.) pp. 27.

Favorable report, with map. July 21, 1882. (House report 1698, Forty-seventh Congress, first session.) pp. 11.

Report of the commission appointed by President Grant to report on the route best suited to the requirements of an interoceanic canal. The commission was composed of General A. A. Humphreys, Admiral D. Ammen, and C. P. Patterson, Superintendent of United States Coast Survey. They recommended the Nicaragua route as the most practicable. (Senate Ex. Doc. 15, Forty-sixth Congress, first session.)

With this report were transmitted to Congress by President Hayes copies of the printed reports of the surveys made under the Navy Department, and three ("written"), viz, those of Maj. Walter McFarland, United States Corps of Engineers, Gen. Jacob Ammen, formerly of the United States Army, and Prof. Henry Mitchell, United States Coast Survey, who had reinspected the Nicaragua, Darien, and Atrato routes. Of these reports that of Professor Mitchell only has been published. [United States Coast Survey Report, 1874.]

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II. *Corinth Canal:*

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III. *Panama Canal:*

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Report of Lieut. R. M. G. Brown to the Secretary of the Navy, on the Panama Canal. June 2, 1884.

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